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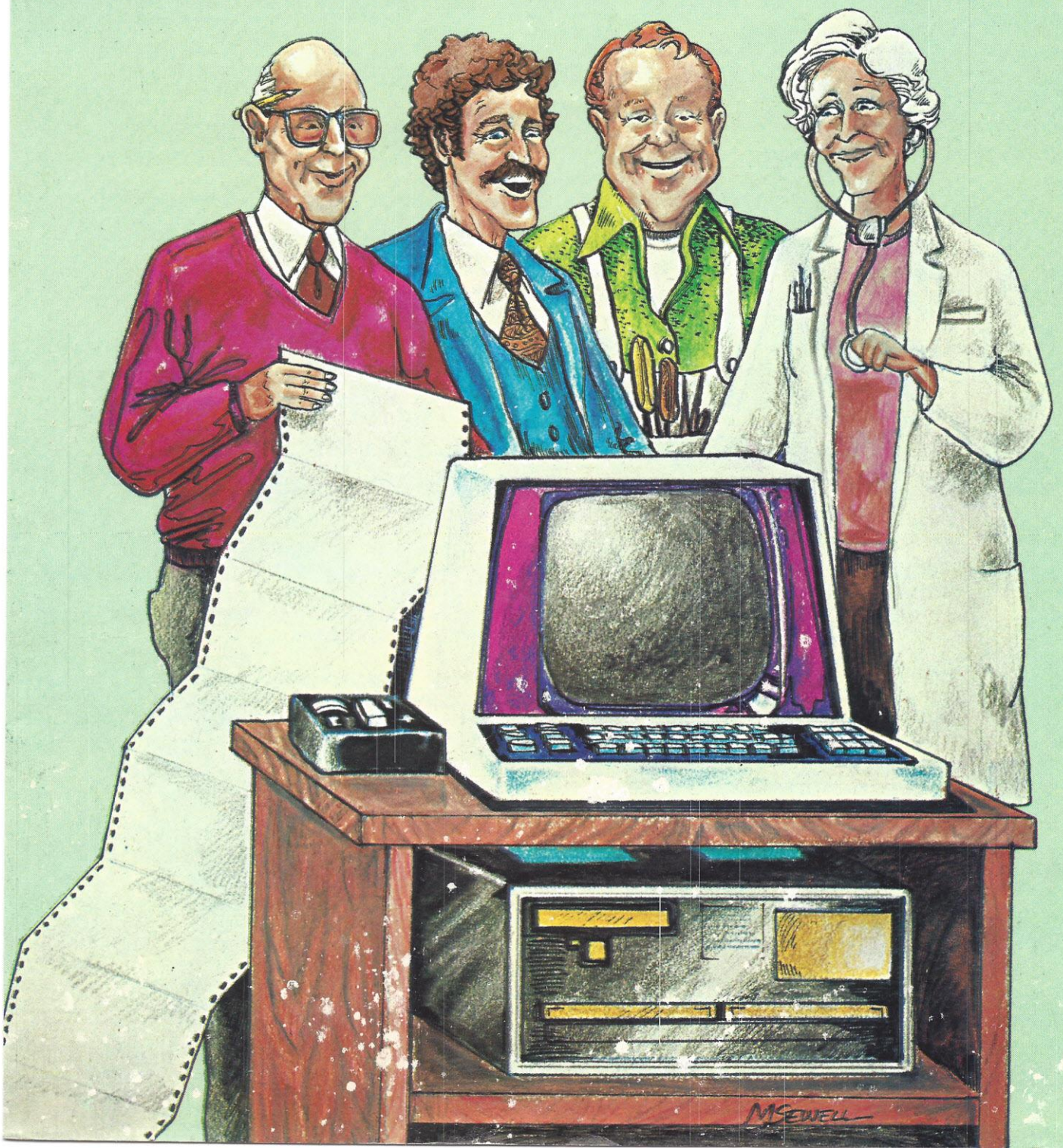

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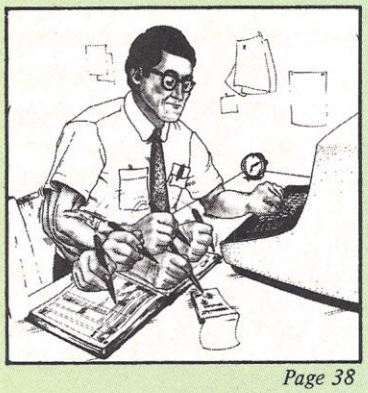
CIRCLE 1

Personal Computing

Publication Number USPS 370-770 APRIL 1979 VOL. III NO. 4



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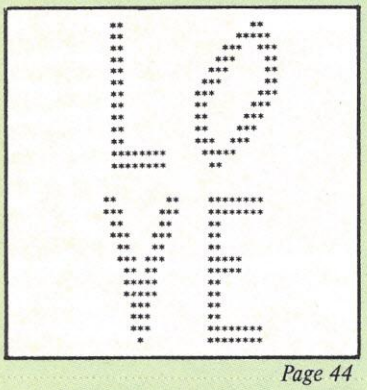

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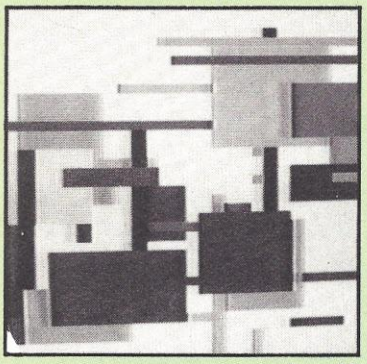

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by Mark Sewell

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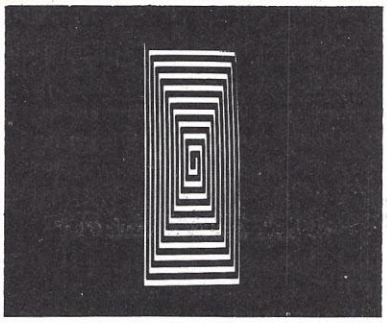
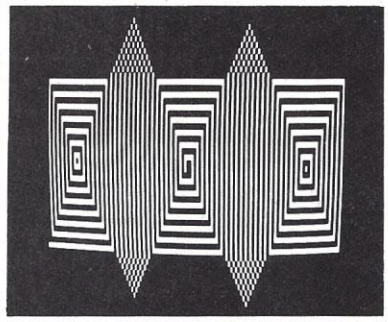
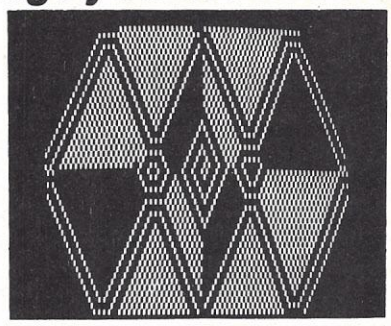
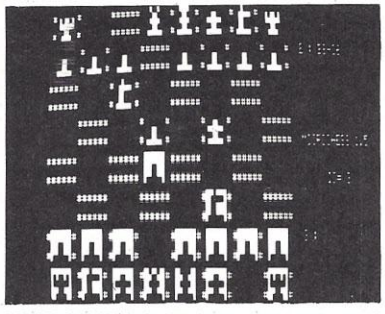
PET / TRS-80 / APPLE: Personal Software brings you the finest!

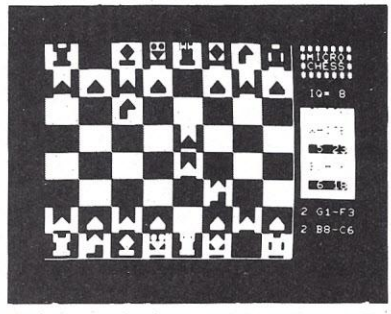


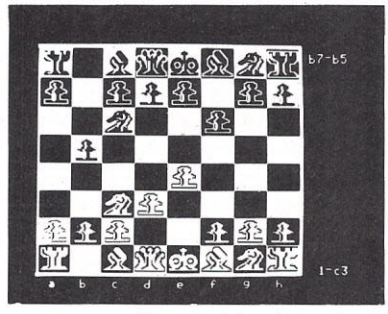




***NEW!* THE ELECTRIC PAINTBRUSH** by **Ken Anderson** for 4K Level I and II TRS-80s: Create the most dazzling graphics displays you have ever seen with a minimum of effort. *The Electric Paintbrush* is actually a simple 'language' in which you can write 'programs' directing your paintbrush around the screen—drawing lines, turning corners, changing white to black, etc. Once defined, these programs may be called by other programs or repetitively executed, each time varying the parameters of brush movement. The machine language interpreter executes your programs almost instantaneously, allowing you to create real-time, animated graphics displays. The screen photos above are actually 'snapshots' of the action of a single one-line program over about thirty seconds. Mesmerize your friends with visual effects they've never seen on a TV screen! There's no limit to the variety of exciting and artistic graphics displays you can create with *The Electric Paintbrush*. And it's available now for only **$14.95**







MICROCHESS is the culmination of two years of chessplaying program development by **Peter Jennings**, author of the famous 1K byte chess program for the KIM-1. MICROCHESS 2.0 for 8K PETs and 16K APPLEs, in 6502 machine language, offers 8 levels of play to suit everyone from the beginner learning chess to the serious player. It examines positions as many as 6 moves ahead, and includes a chess clock for tournament play. MICROCHESS 1.5 for 4K TRS-80s, in Z-80 machine language, offers 3 levels of play (both Level I and Level II versions are included and can be loaded on any TRS-80 without TBUG). MICROCHESS checks every move for legality and displays the current position on a graphic chessboard. You can play White or Black, set up and play from special board positions, or even watch the computer play against itself! Available now at a special introductory price of only **$19.95**

BRIDGE CHALLENGER by **George Duisman** for 8K PETs, Level II 16K TRS-80s, and 16K APPLEs: You and the dummy play 4 person Contract Bridge against the computer. The program will deal hands at random or according to your criterion for high card points. You can review tricks, swap sides or replay hands when the cards are known. No longer do you need 4 people to play! **$14.95**

TIME TREK by **Brad Templeton** *with sound effects* for 8K PETs is **Personal Software**'s answer to the proliferation of Star Trek games. This is a real time action battle game which requires fast thinking as well as sharp wits. There are no 'turns' in *Time Trek:* your scanners and ship's status report are constantly updated on the screen, and you can enter commands as fast as you can press the keys. You use your shields, phasers and photon torpedoes against enemy Klingons in a game where you can move, steer and fire at the same time. Star Trek aficionado or not, you'll appreciate the excitement and excellence of this real time game..... **$14.95**

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CIRCLE 53

FEEDBACK

Metaphysics and Computers

Gentlemen:

I wish to reply to your response to my letter, as published in the January issue.

First, I question the logic of your response. The Wright Brothers accomplished what had already been proven in nature. The science of aeronautics was put into practice when the first winged creature took off. Likewise, immunology had been taking place long before Jenner and others. Vaccination took place by exposure to disease (usually inhalation of bacilli). But can anyone show me in nature where inanimate, inorganic matter exhibits thought processes?

Second, what's to be gained from a machine that is self-aware, or is emotional? The purpose of computers is to improve the quality of human life. What good will it do to build machines that *add* to man's burdens by requiring emotional fulfillment and attainment of self-created goals? Will they not compete with man in these areas? With the earth's resources dwindling, such competition can only be detrimental to mankind. Do you feel that intelligent machines are man's evolutionary successor? If so, do you feel that this evolution should be sponsored by man?

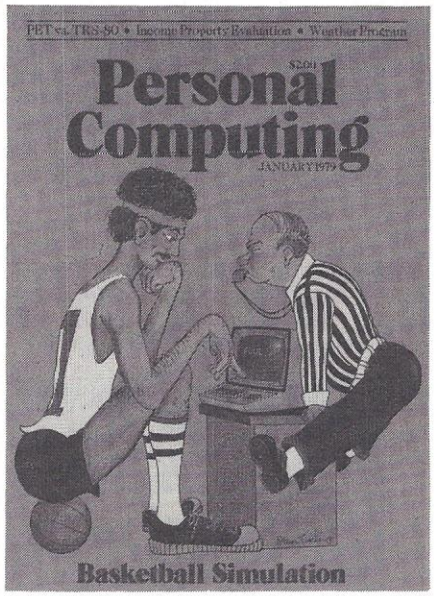
Please understand — I like computers a whole lot! I like them because, as servants, they are superior to people. Ideal servants put their master's needs first. Ideal servants don't go out on strike, don't loiter around water coolers, etc. A computer is ready when you are, works any hours you choose. That's because computers have no needs or wants of their own. If they are made self-aware, their needs and wants will create conflicts with man's needs and wants.

Bruce Showalter
Abilene, TX

Dear Mr. Showalter:

Let me expand on my original response and on your present letter.

Technology bends nature and nature's laws to the will of Man. A person cannot fly like a bird; flapping our arms



gets us nowhere. So we twist nature slightly. We use nature's materials and nature's laws to build an airplane.

Likewise with vaccination. Instead of relying on natural immunization, we use vaccines produced in the laboratory to insure maximum benefit at minimum risk.

True, you can't point to inanimate, inorganic matter in nature exhibiting throught processes. But neither can you point to inanimate, inorganic matter in nature that flies.

There *may* be some fundamental, underlying reason why computers cannot imitate human intelligence and emotions. But there's no scientific evidence yet to indicate such a basic stumbling block exists. The current arguments against artificial intelligence are based on religion, fear and "metaphysics" — arguments on a level with "If God wanted man to fly, He would have given him wings."

Believing there can never be such a thing as a thinking, feeling computer will not stop the rapid progress being made at AI labs around the world. And if one day they produce a thinking machine, you'll find that your blind faith in the impossibility of the creature has left you unprepared for its reality.

The future is not a nebulous time a hundred years away. The future starts *now*. And if you don't prepare for the potential wonders and horrors the future may bring, you'll find that the future will (at worst) steamroller you flat or (at best) leave you a confused stranger in a strange world.

Now is the time to start thinking about the good and the bad that may come from artificial intelligence. (Technology always has unfortunate, dangerous side-effects. Automobiles, for example, produce instant death and disfigurement on the highways, pollution in the air and traffic jams at rush hour.) Since you've listed some of the negative aspects of machine intelligence, let me list some of the points in its favor.

Thinking, feeling computers may well become our partners and companions, with their machine thoughts, emotions and capabilities complementing our human ones. For example, intelligent robots could explore Venus, Jupiter and the other planets where men cannot easily go. They could mine the Moon (or the Earth, too, for that matter). Machine intelligence, with its fresh, alien perspective, may help us solve the problems that overwhelm our human intelligence — war, pollution, overpopulation, starvation and poverty, to name a few.

I don't *know* that these things will come to pass; I can't predict what wonders or horrors machine intelligence will bring. I can only quote Michael Faraday: "What good is a new-born baby?"

Now is the time to think about that baby's future, and our own. And to remember that both Faraday and Hitler started out as cuddly tots.

—Don Wood

Dear Don:

I am keeping an open mind as to the potential of artificial intelligence. However, I have been prejudiced by the movies "Collossus (The Forbin Project)" and "Demon Seed". If self-aware computers become a reality, they *must* be programmed with an unfailing code of ethics, such as Asimov's three laws of robotics concerning men and machines. Otherwise, an ambitious machine could pose a threat to humans. I trust that computer scientists will always provide a fail-safe means of turning machines off, or otherwise restrict their power and abilities. Even electricity, confined as it is in circuits, must have an interrupt device at the

INTRODUCING G2 LEVEL III BASIC.

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Easier Loading, Fewer Keyboard Errors. G2 Level III Basic eliminates aggravations you've had, including keyboard "bounce" and those super-sensitive tape deck settings. Programs will load easier, and you'll have far less trouble with input errors.

Basic Access to RS-232. Until now, if you wanted to access your RS-232 interface, you had to work in assembly language. G2 Level III Basic does the work for you, letting you use your interface with Basic statements.

Have You Wished for More Power? This new interpreter gives you 10 machine language user calls for subroutines, long error messages, a new TIME$ call for your real time accessory, plus measure or limit input timing that lets you put a time limit on responses when you're playing games or giving exams. And the list doesn't stop here.

Easier and More Powerful Graphics. This new Basic includes three simple commands that can eliminate dozens of program steps. PUT transfers information from a designated array to your screen; GET reverses the process. LINE makes your computer do the work when you input beginning and end points. Give it two diagonally opposite corner locations, and it'll outline the rectangle you're looking for.

Only Microsoft Could Do It. G2 Level III Basic was created by Microsoft, the same company that wrote Level II Basic for Radio Shack. And it actually uses Level II as a foundation for this enhanced add-on. By the time you've mastered all it can do, calling up the flexibility of the graphics commands, and even enjoying the convenience of renumbering, you'll wonder how it was all possible. It's like getting a whole new computer for your computer.

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CIRCLE 6

generator. Otherwise, fallen power lines would be nearly impossible to repair or make safe.

If an animal or human goes berserk, the creature can be terminated. Even raging rivers can be dealt with. But anything capable of "thinking" its way around man-made obstacles will be most difficult to stop, should stopping become necessary.

I have no objections to a machine being self-aware, so long as it can not influence its environment as much as man can. In other words, if it comes to a showdown between men and machines, I want men to win.

Probably, I'll not be around to see such a showdown. So, lets let technology take its course. I'm waiting for the day when I can buy a 24K memory computer with 8½" wide printout and keyboard and mag tape I/O for less than $300. I hope it's tomorrow!

Bruce Showalter
Abilene, TX

TRS-80 Recorders

Dear Editor:

I purchased my Level I, 16K TRS-80 system on September 20, 1978, from Radio Shack #6443 in Willowbrook, IL. When I opened the box, I discovered that, instead of the advertised CTR-41 cassette recorder, there was a model CTR-40. The difference is significant, since the CTR-40 lacks a footage counter, making it difficult to operate with multiple files on a cassette tape. Further, the volume control is not calibrated, making it difficult to reproducibly adjust the notoriously touchy volume level in the TRS-80 system. Finally, there was no tone control as on the CTR-41. When I protested to the store owner, he stated that "this was how all TRS-80s are being shipped now", and that since I was "being given the recorder for free" that I could have no complaint. I persisted, and after being told that there were no CTR-41s available in the entire Chicago area, he finally agreed to swap the new CTR-40 in the TRS-80 box for a CTR-41 attached to a demonstrator system in the store.

I should make it clear that I have been entirely pleased with my TRS-80 system, and have in fact recommended it to several friends. It has operated perfectly from the moment I turned it on, including the "demo" recorder that I had to bargain to get. However, I think that other prospective purchasers ought to be aware of what they will get, especially since it is different from the representations of the manufacturer. (There is a further source of potential confusion to computer neophytes in that the Radio Shack Level I BASIC manual is quite specific in how to adjust the CTR-41 controls to get correct operation — controls which don't even exist on the CTR-40.)

In my opinion, Radio Shack owes its new customers at least a written explanation of the switch, directions as to how to reliably operate the CTR-40, assurance that it will reliably read Level II tapes, a $10 rebate reflecting the price difference from the advertised system, and a trade-in credit of the full retail price of the CTR-40 if the purchaser wishes to trade it in on a more expensive model that has the features I have described above. Any less than this does not constitute full honesty in dealing with the public, I believe.

I would like to reiterate that I am personally satisfied with my system, and have no personal complaint against Radio Shack apart from the necessity of having to bargain to get what I was promised in the catalogue. However, others may not be so fortunate.

Charles E.W. Ward
Hinsdale, IL

Radio Shack responds: We have supplied three different cassette recorders with the TRS-80 — the CTR-41, the CTR-40 and now the CTR-80. Used with the TRS-80, all are comparable in performance. Our use of different recorders was caused by supply problems.

The CTR-40 did come with an instruction sheet on its use and the volume control was hand calibrated for both Level I and Level II use. The lack of a tone control improved its data performance and our tests indicate it performs slightly better than a CTR-41.

The CTR-40 does not have a tape counter as does the CTR-80 and CTR-41, which could be a problem for some TRS-80 users. If a TRS-80 owner with a CTR-40 who desires to switch to a CTR-41 or CTR-80 will contact me I will arrange it. We will require that the CTR-40 be returned complete and in good working order. As the recorder is included free with the system, we cannot consider Mr. Ward's rebate request.

Finally, we are now supplying the CTR-80 recorder, similar to the CTR-41 and 40, with a tape counter and fast forward/rewind controls that no longer require pulling the remote control plug. This new recorder should satisfy any TRS-80 purchaser.

Jon Shirley
Vice President, Computer Division
Radio Shack
Fort Worth, TX

"I think that I shall never see . . ."

Eminent Sir:

I've been pleased with what I've read in your magazine — some of the ideas are very helpful. But, I do have one frustration. . .

I think that I shall never see
a program listed error-free
On glossy page of magazine
where micro-nuts a trick can glean.
It seems no matter with what care
the author did de-bug his ware,
Some printer's devil's sneaky way
will let the routine go astray.

It only takes a mis-typed "I",
or is it "one" — I squint my eye —
To make a neatly indexed loop
a trap; and I'm the hapless dupe.
Or is it all a trick on me
to prove superiority
(or throw a challenge to my wit?)
of he who writes, or edits, it?

I'm a sucker for each subroutine
that promises a model clean
To code my algorithm neat
or quickly do some useless feat.
And now I'm watching — let it hide!
for one that works the first time tried;
I'll seek it out forever more,
'Til Satan walks on frosted floor.

Richard M. Straw
Klamath Falls, OR

Everybody's making money selling microcomputers. Somebody's going to make money servicing them.

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And you build your own microcomputer, the only one designed for learning. It looks and operates like the finest of its kind, actually does more than many commercial units. But NRI engineers have designed components and planned assembly so it demonstrates important principles, gives you working experience in detecting and correcting problems. It's the kind of "hands-on" training you need to repair and service units now on the market.

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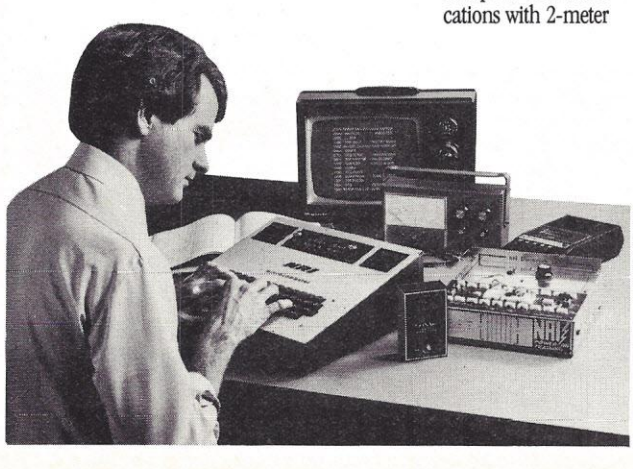

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CIRCLE 7

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Our New Catalog

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RANDOM ACCESS

Apple Slices Grocery Bills

An Apple II computer is helping to provide nutritional and economical meals to thousands of low income families and senior adults. The experimental program is intended to stretch food buying dollars for people on fixed incomes living in the Miami, Florida, area.

The Apple II serves as an output terminal to a large general purpose computer which monitors the best food buys available at over 700 food stores in Dade and Broward counties. Approximately 1000 food items advertised weekly in the two local papers make it virtually impossible for an individual to manually select the best buys consistent with a well balanced diet. But as part of the program, a weekly computer analysis, available to the public, reflects the lowest available prices on specific food items, the individual markets or food chain offering these items and a weekly menu plan making use of the advertised specials.

This Consumer Computer Project is operated by the Community Resource Center of Miami which administers the program for Cooperative Extension, a part of the Department of Agriculture. Funds are provided by the U.S. Department of Agriculture, Land Grant Universities, local municipal governments, and the Expanded Food and Nutrition Program (EFNEP) — a federal project for limited income families.

Initially intended to serve approximately 1000 low-income families and senior adults using food stamps, the program is rapidly being accepted by many middle income and even higher income families interested in stretching their food budgets. Approximately 20,000 families at all income levels make use of the computer analysis provided each week.

The Apple II is linked to a large computer, operated by International Computer Systems in Coral Gables, where data on more than 85,000 food items are stored. After analyzing current sale items, the computer makes several printouts.

One printout alphabetically lists the sale items in each grocery chain and the associated unit measure prices. A second printout provides a weekly menu plan based on 500 recipes stored in the computer and matched to those items on sale. "All suggested meals are nutritionally balanced and recommended by the Department of Agriculture. Each meal includes one meat, one vegetable, one fruit, one bread, one beverage and one starch item," according to Mike Shulman, program director.

Advertised items from all chains and independent markets are compiled. Printouts list the least expensive item in any given food category and the store offering it. Finally, a trend analysis shows whether the current prices are higher or lower than the previous week's price — or the price when that item was last advertised.

In addition to the seven large food chains in the area, the survey also includes 25 independent markets and nine food cooperatives, many of which are located in poor Hispanic or geriatric areas. All the data is collected from advertisements run in two local newspapers which together run approximately 40 to 50 pages of food advertising each week.

The free computer printouts are publicly displayed at 25 local libraries and five mobile libraries. The Cooperative Extension also mails computer printouts to interested people and provides the information to the local TV and print media. In fact, the information from the newspaper advertisements is compiled and analyzed so rapidly that the newspapers present the computer output data in the same editions carrying the food advertisements.

Radio stations receive several pre-recorded tapes of excerpts from the full computer analysis. Tapes discuss some of the best buys for the week, various menu

plans and their nutritional value.

The weekly analysis is also available at a mobile terminal which visits various shopping centers and high traffic areas within Dade and Broward Counties. On the Apple's TV monitor, the public can view the full output. All data for that week is stored on a floppy disk, any portion of which the Apple II can access quickly.

The entire mobile terminal, including a TV monitor, impact printer and a floppy disk, can fit into the trunk of a Porsche. The computer and peripherals operate from the car battery. An inverter converts the car's DC battery power to 115 VAC, and a switch races the car engine to charge the battery during computer operation.

With the Disk II floppy disk subsystem, the computer produces a file index of the vitamins, nutrients and carbohydrates associated with each menu plan.

The Dade and Broward county area was selected for this pilot program because of the heavy predominance of senior adults and their concern for obtaining nutritional meals on fixed incomes. 39 additional programs are planned in the U.S. by 1983.

Computer Locates Compatible Donor Kidneys

When a donor kidney becomes available for transplanting, a compatible recipient must be located in the fastest possible time since the kidney transplant must be completed within 24 hours (and ideally inside 20 hours) to be successful. In France, this problem has been solved through a real-time computer program known as RITRAN, which rapidly selects those persons with the most compatible medical characteristics from a list averaging about 1800 possible recipients. The computer picks out a number of names, but the physician in charge of the transplant operation makes the final selection of the recipient.

The list of possible recipients and their medical data is kept on magnetic tape in a direct access file of a UNIVAC 1108 computer system owned by Air France and sited at the airline's computer center at Valbonne, southern France. This file can be accessed by physicians on a round-the-clock basis.

The computerized transplant service is managed by Association France-Transplant, headquartered at the Saint-Louis Hospital, Paris. Air France provides its computer services to the Association.

Twenty-six medical/surgical teams throughout France and in Switzerland, Holland and Spain use teletypewriter terminals to communicate directly with the 1108 system in Valbonne and with each other.

Upon receiving the characteristics of the donor kidney, the computer searches its file and responds with a list of coded information giving data on persons with the same or very similar compatibility features.

The information lists the person's name, his country, city, sex, date of birth and transplantation team. The essential medical data includes blood group, graft urgency, Human Leucocyte Antigens (HLA, individual identifying cell markers used as compatibility identifiers), the existence of preformed antibodies, dialysis schedule, any temporary incompatibilities and emergency data. Another consideration is the priority factor — how long has the person been on the waiting list for a kidney transplant? The minimum risk is entailed in the transplant operation when both the donor and recipient's HLA is identical.

The list of recipients is updated daily through the teletypewriter network using a program known as RITREC. Currently, about 500 kidney transplants are performed yearly in France, with most of the recipients selected through the Association. On an average day the UNIVAC 1108 computer processes from two to four inquiries concerning recipients. The success rate on renal transplants in France is currently running about 60%.

Association France-Transplant was created in 1969 to coordinate the work of the various medical/surgical teams performing kidney transplant work in France, as well as with other European organizations engaged in similar activities. Other European groups include UK Transplant (in the United Kingdom), Eurotransplant (in Belgium, Holland and Luxembourg) and Scanditransplant (the Scandinavian countries — Sweden, Norway, Denmark and Finland).

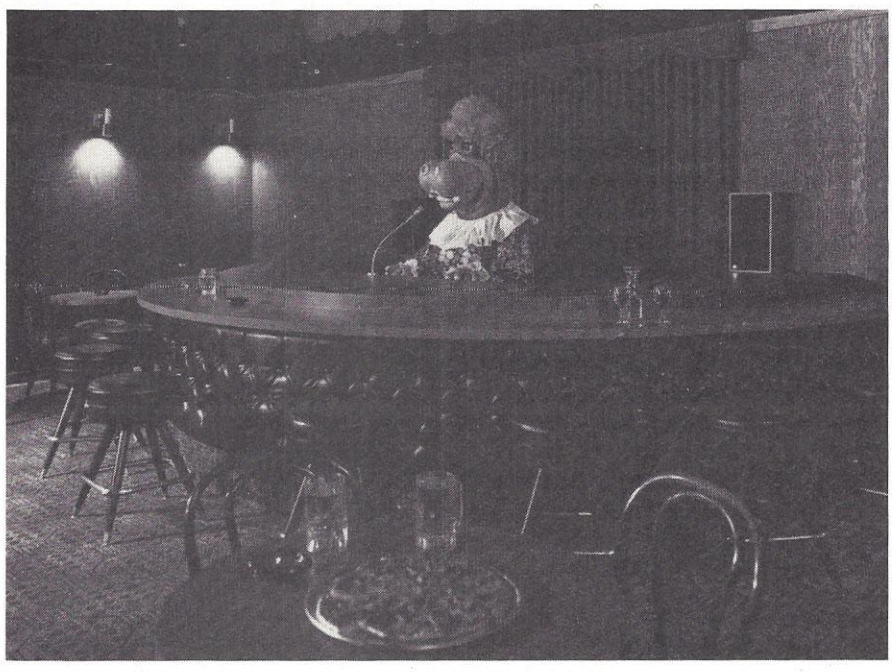
Another version of the RITRAN program keeps on file a choice of blood donors compatible for persons who may need transfusions of special types of blood cells, such as leucocytes, which help maintain immunity to infections, and platelets, which function during blood clotting.

Club News

Two new general-interest computer clubs have been formed. The Educational, Recreational Computer Club (ERCC) of Owosso, MI, offers monthly meetings with speakers, discussion and trade of programming ideas. A club newsletter, published monthly, costs $2.50 a year for non-members. For information contact Paul Heimnick, President, 1415 Olmstead St., Owosso, MI 48867; (517) 723-7602.

For information on a new club in Phoenix, contact Marc Tessler, 3520 W. Dunlap Ave., #106, Phoenix, AZ 85021; (602) 249-6224.

Pizza Time Theater Features Computer-Controlled Puppets



Pizza Time Theatre of Mountain View, California, uses a computer to produce a vaudeville show with three-dimensional, computer-controlled cartoon characters. The new company is opening a series of family entertainment centers.

According to Director of Entertainment Mike Hatcher, Pizza Time uses a Digital Equipment Corporation PDP-11. "I added," says Hatchers, "a Sykes floppy disk with a 32K memory. All the equipment we use was specially designed for Pizza Time's first two locations. As the company expands this winter into new locations, we will actually begin manufacturing the necessary components."

In San Jose, where Pizza Time Theatre operates one of the country's largest pizza parlors, complete with animated show and the latest video, pinball and arcade games, Hatcher developed the program that will be used for future Theatres.

"My job is really electronic puppeteering, except instead of strings to move the characters, I use control levers and buttons. The shows are all programmed in real time, including the movements, sound effect, music and lighting cues. The biggest problem," says Hatcher, "was assigning eight speakers around the dining room to three channels, but I enjoyed the challenge."

To program the show, Hatcher punched in his own set of symbols, which was then recorded on tape. Coordinating everything to the pre-recorded sound track took about three hours for every one minute of actual show.

Hatcher is directly responsible for all entertainment, including character specifications and design, premium sales, production and animation for the Cyberamics characters, including seven major players in the Pizza Time company, as well as a life-sized hippo, Dolli Dimples, who presides over the piano bar.

After creating personality profiles for Chuck E. Cheese, Jasper T. Jowls, Mr. Munch, Pasqually and four guest stars, Hatcher submitted his sketches to Fantasy Forest in Apple Valley for construction. A team of artists first built a metal "skeleton", which was covered with foam rubber, latex, fiberglas or fabric, depending on the character.

While Fantasy Forest was building the figures, Hatcher worked with scriptwriter Bob Black to develop a series of 22 skits, each running three to five minutes, for the main dining room show. For Dolli Dimples, 19 song medleys were developed. The sketches were recorded under the musical supervision of Jeff Nabors, a San Francisco musician.

Once the engineering staff finished installation of the main characters, plus applauding hooves and clapping pots and pans and waving flags, Hatcher began the tedious job of making everything and everyone move to the soundtrack.

"Each character has its own personality traits," said Hatcher. "For instance, Chuck E. Cheese blinks incessantly, while Jasper T. Jowls, the dog, moves his eyes from side-to-side. When Helen Henny, our female vocalist, sings, she throws back her head and closes her eyes."

Most movement coincides with the musical track. Hand gestures punctuate beats, eyelids open and close to music, head movement ties in with drum rolls.

Hatcher's favorite? "Without a doubt, it's Dolli, who sings old standards in her own inimitable sultry hippo style." Her 16 movements include ears that twitch, eyelashes that flutter and aqua eyes that roll.

Pizza Time Theatre's Cyberamic animation program required a $1,500,000 development effort centering around extensive use of sophisticated hardware and software. A glassed-in control room in the dining room allows guests to watch the tape record, minicomputer and keyboard.

The first two Pizza Time Theatres are open in San Jose with a third to be opened in Concord. A fourth unit is scheduled for June in Southern California with other locations under consideration in Marin County and San Joaquin Valley before beginning nationwide expansion.

Computer Keeps America Singing

Harmony Hall in Kenosha, Wisconsin, is headquarters for the Society for the Preservation and Encouragement of Barber Shop Quartet Singing in America, claiming to be one of the world's happiest organizations. A Honeywell Series 60 Level 62 computer system is a major part of this singing society.

SPEBSQSA needs a computer to help keep track of its more than 36,000 members, organized into 780 chapters and spread across every state of the United States and most provinces of Canada. And there are chapters in the United Kingdom, West Germany and Sweden.

Frank Santarelli, data processing and accounting services manager of the organization, points out that in addition to individual membership and chapter information the computer also is used to maintain and administer an elaborate inventory of such items as sheet music, keychains, T-shirts, sweatshirts, jackets and hats, all emblazoned with the organization's insignia.

The Society does a lively direct mail business in these items the year 'round as well as at its various regional meetings and songfests and at its annual convention.

The Honeywell Level 62 computer system, comprising the computer with 160K bytes of memory, two disk drives, a 300 lpm printer and two VIP 7700 video display terminals, also handles the Society's bookkeeping and accounting. Although tax exempt, the Society and its chapters are required to file transaction summary documents with the Internal Revenue Service each year. Santarelli explains that the computer is used to prepare these summaries. It also does the payroll for the Society's 30 plus employees.

Executive director Hugh Ingraham says that "barbershop quartet" actually is a misnomer. Most of the members sing in choruses — some as large as 150. But what they do is sing barbershop harmony — one of the three native American music forms, the other two being jazz and cowboy ballads.

Ingraham, Santarelli and the entire SPEBSQSA are sure that the Level 62, humming away at Harmony Hall West, will help the Society perpetuate "the old American institution, the Barbershop Quartet, and promote and encourage vocal harmony among its members throughout the world."

Small Aircraft Navigate With Calculators

A compact, portable system using a programmable calculator simplifies enroute navigation for small airplane pilots.

Previous equipment, designed for large planes, became highly advanced and very expensive, reaching beyond the means of small plane owners. In addition, many older planes, built before the electronic revolution in navigation, have no such equipment. This means there is a wide range of navigational equipment aboard the small, private aircraft of the world; each pilot learns the techniques available on his or her plane.

Some pilots, like air taxi pilots and flight instructors, must be considerably more versatile. They must adapt immediately to a variety of airplanes, regardless of the equipment. These pilots are constantly looking for ways to improve the continuity of navigational equipment from plane to plane.

Now, a Montana flight instructor may have discovered a solution to this problem through the use of special programs that he has developed for his handheld calculator. Robert L. Michael, chief pilot for Sunbird Aviation, Belgrade, Montana explains, "In the Air Taxi business, I find myself flying a variety of aircraft, to places I have never been, and often have very little time for any preflight planning."

Michael already owned a Hewlett-Packard Model 25 handheld programmable calculator and began to put together programs with it. When HP introduced the Model 29C, a more powerful version of the HP-25 with the added advantage of continuous memory, Michael used it for programming.

"The HP-29C proved its worth to me on several occasions, particularly at night or in marginal weather conditions," said Michael. "When course deviations are required, it becomes of extreme importance to know precisely where you are — and it always seems as though there is never a ground navigational aid around to tell you where you want to go. I found the portable

calculator to be small and flexible enough that I would easily fly the aircraft without an autopilot and still use the calculator as a navigational instrument."

Michael recently purchased HP's most powerful handheld calculator, the magnetic card programmable HP-67, selling the HP-29C to a fellow pilot who was impressed by its accuracy. HP-67 programs can be permanently recorded on magnetic strips smaller than sticks of chewing gum. This means that more than one program can be kept.

Michael developed a number of programs for the HP-67. For example, with one, he need only enter the longitude and latitude coordinates for his destination and two VHF omnidirectional ranging stations (VORS) and their radials, the wind direction and velocity (as reported, and, after 3 or 4 plots, its exact parameters) and the true air speed of the plane. The calculator then generates a measurement of the range of the first designated VOR, heading, groundspeed, remaining distance and ETA to the destination. Not only is the calculation extremely accurate, but at very close ranges, where the slant is steep, more accurate than many built-in systems costing thousands of dollars.

Says Michael, "Not only is the calculator useful in VHF areas, but also in less developed country, like Alaska and Northern Canada, with an Automatic Direction Finding (ADF) network or anything else that gives a reference to a ground station. Even without any navigational equipment aboard the aircraft, the pilot can use the HP-67's sun line of position program to locate the proper position of the sun or a star to give headings and to plot timed turns.

"At least for me, the HP-67 calculator has proven to be a significant step in the development of a simple, but reliable method of navigation which does not seek to bring more 'numbers' into a pilot's work load, but instead allows him to direct more of his attention to the process of flight management."

Frankly, Scarlet...

Scarlet (Southern California Array for Research on Local Earthquakes and Teleseisms) consists of 140 sensitive seismographs scattered throughout southern California, and connects to a computer system which can quickly and accurately determine location and magnitudes of earthquakes in the area. The system is also routinely used to study earthquakes elsewhere in the world.

According to Don L. Anderson, director of Caltech's Seismological Laboratory, Scarlet was brought into full operation last year with the addition of a computerized earthquake detection system developed by graduate student Carl Johnson. When linked to the seismographs, which have increased in number since the first installation in 1926, the computer system could automatically detect and record earthquakes with magnitudes as small as about 1-1/2, eliminating an enormous amount of hand labor required to find and analyze the records of earthquakes on paper or film records. The system can also detect more earthquakes than is possible by human scanning of the extensive seismic records, because it can discriminate them better from background noise. Automated calculation of earthquake data also allows more earthquakes to be included in the laboratory's earthquake catalogs.

For example, the first computerized earthquake catalog using the Scarlet contained data on almost 6000 earthquakes occurring between January 1977 and March 1978. Only about 15,000 were included in the previous hand-prepared catalog, which listed earthquakes for the 40-year period 1932-1972.

The Scarlet name was arrived at by conducting a contest at the Seismological Laboratory. The winner just happened to be a graduate student named Rhett Butler.

Plato Aids UnitedAirlines

The PLATO computer-based education system has a major role in United Airlines' new pilot training program, expected to add 1800 pilots between now and 1983.

The system is the "first new-hire program in nine years," said Grant Beutler, Manager of Training Program Development at United's Flight Training Center in Denver. "We needed a quick and accurate way to test candidates, keep track of individual progress and make sure the instruction complemented each pilot's background in order to expedite the training schedule."

United installed eight Control Data PLATO computer-based education terminals which handle testing and scoring, prescribe study activities, display pilot progress and provide data for evaluating the effectiveness of the instructional materials.

Results of the new pilots' first test determines what their training should include. This guide may be in the form of manuals, films, videotapes and so forth. Pilots return to terminals whenever they feel prepared for another test.

If the pilots pass, they have demonstrated satisfactory knowledge of the subject. Otherwise they are given additional study materials to work with.

"With this method we don't spend time and money teaching pilots what they already know," said Beutler.

The system, noted Beutler, responds to individual learning needs. Not only the subject matter for a particular student is selected, but also the media through which it's delivered.

Education for Calculator Customers

Texas Instruments has taught thousands of its own employees how to utilize the advanced capabilities of the TI Programmable 58 and 59 calculators to make their jobs easier. Now, the expertise gained in the internal productivity improvement program is available to TI customers through Texas Instrument's Professional Productivity Program.

TI offers programming education to quickly familiarize new users with the capabilities of the TI Programmable 58 or 59, even if they have no previous programming experience. For large organizations, TI has a five-day instructor course to train members of the customer's staff to effectively administer the two-day user course. TI also offers a Professional Productivity Seminar designed to teach even those unfamiliar with programming how personal programming can increase their creative time by decreasing time-consuming repetitive tasks.

The Professional Program Exchange (PPX), which makes software developed by current TI-59 and 59 owners available to new owners, is also available to corporations. Corporate membership includes all software currently available in PPX on microfiche and periodic updates as new programs become available. By having the PPX library of programs in-house a company encourages enployees to browse through the available material and possibly discover new uses for programmable calculators.

In addition to software in PPX, TI also offers Solid State Software modules which can contain as many as 5000 program steps. The modules plug into the TI-58 and 59 calculators greatly extending the capabilities of these units. There are presently 13 standard libraries covering areas of specialization as diverse as farming and electrical engineering. If a standard module does not exist for an application which a customer has in mind, TI is now offering custom libraries. OEM suppliers, professional societies or individual companies can have special software requirements of up to 5000 program steps translated into custom modules. Separate programs in the module can share common subroutines making even more space available. Programs in a Solid State Software module cannot be erased accidently and can be protected to prevent disclosure of proprietary information.

Through TI's Professional Productivity Program a customer can structure a program to suit special needs. Training, custom Solid State Software, standard library modules, specialty packettes and PPX can be combined into individualized packages.

Trenton Computer Festival

The fourth annual Trenton Computer Festival will take place on April 21 and 22. TCF-79 is sponsored by the Amateur Computer Group of New Jersy, the Trenton State Computer Group, the Philadelphia Area Computer Society, Trenton State College Engineering Technology Department and the Princeton chapter of IEEE.

Facilities will house up to 90 exhibitors according to festival officials. In addition there will be 30 speakers/forums and an outdoor flea market. Over 8000 attendees are expected.

For more information contact Dr. Allen Katz, Trenton State College, Hillwood Lakes, P.O. Box 940, Trenton, NJ 08625, (609) 771-2487; or Sol Libes, Amateur Computer Group of New Jersey, UCTI, 1776 Raritan Road, Scotch Plains, NJ 07076, (201) 277-2063.

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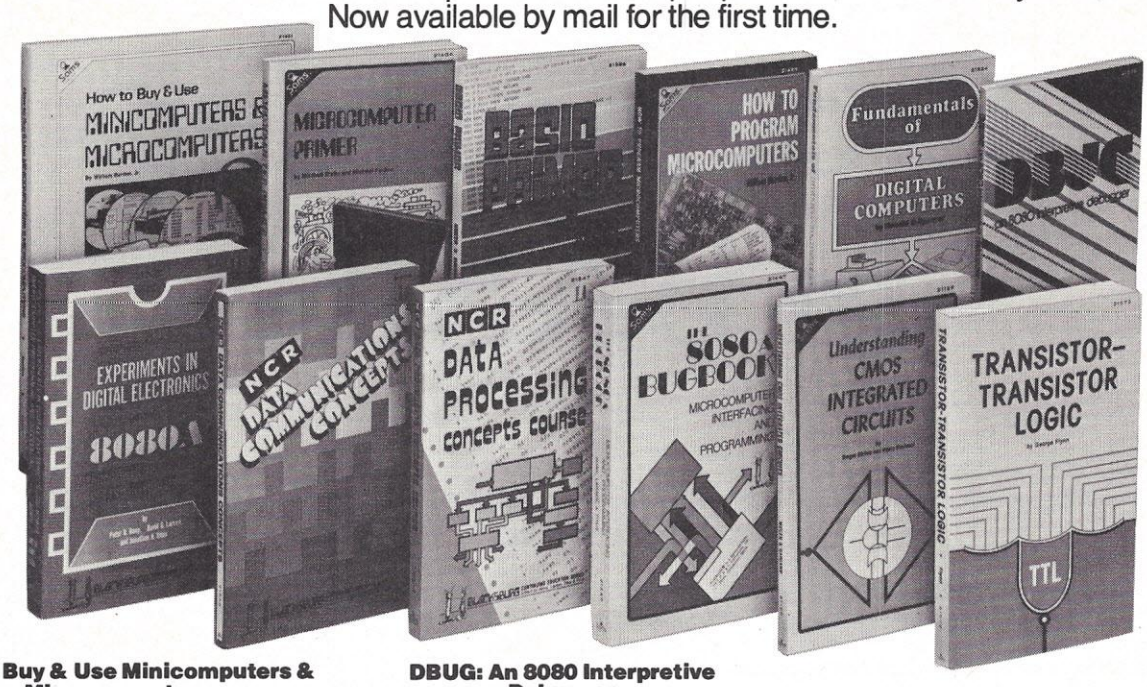

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CIRCLE 8

Recursive Programming in BASIC

BY HERBERT L. DERSHEM

Recursive algoithms are anathema to the personal computing programmer. Their reputation suffers from the belief that recursion requires a large, powerful computer and a fancy language. People consider recursive programming so complicated that you need a degree in computer science to understand it. But no one with that much experience would bother with recursion. It is, so the myth goes, highly inefficient, wasteful of resources and only a toy for academics to play with.

But the myths are false. Recursion can be a valuable tool on a personal computer using BASIC and should be in every programmer's repertoire.

Anything is recursive if it is defined in terms of itself. In programming, a recursive subroutine is one that calls on itself. People commonly confuse recursion with iteration; both can be used to solve the same problem.

But recursion and iteration are clearly distinct. A procedure is iterative if the same process is performed many times. A procedure is recursive if in the middle of its execution it calls upon itself. A recursive procedure begins another execution of itself before the original is finished. Such a procedure has more than one execution in progress at a given time; an iterative procedure never has more than one.

Not every language implementation permits recursion. In BASIC, recursion is only possible if it is permissible to call a subroutine from itself and still retain the ability of the original execution to return to the proper point. The following program can test your BASIC for recursion capability.

```
10 REM TEST FOR THE ABILITY OF THE
   BASIC TO PERFORM RECURSION.
20 N=1
30 I=0
40 GOSUB 100
50 IF I<>2*N-1 THEN 170
60 PRINT "RECURSIVE";N-1;"TIMES."
70 N=N+1
80 GOTO 30
100 I=I+1
110 IF I<N THEN 130
120 RETURN
130 GOSUB 100
140 IF I>2*N-1 THEN 170
150 I=I+1
160 RETURN
170 PRINT "NOT RECURSIVE";N-1;"TIMES."
180 END
```

Every call of subroutine 100 increments I by one. The Nth call will result in I being set to N and a return without a recursive call. This will return to each of the previous levels, incrementing I by one on each return. On the final return, I should equal 2*N-1 if the process was carried out correctly. Thus, if the above program runs for a given value of N, the version of BASIC used will allow N-1 recursive calls. Many versions of BASIC have virtually no limit on the number of such calls possible. If the BASIC is not recursive to the appropriate level for some value of N, it will usually respond with some type of diagnostic message rather than arrive at statement 170.

If your computer's BASIC allows recursive subroutines, you now face the problem of writing them. Here's a general outline of a recursive subroutine in BASIC.

1. If the first call, initialize the stack pointer.
2. If termination condition, compute result; decrement stack pointer; return.
3. Do computation.
4. Save necessary values in stack.
5. Increment stack pointer.
6. Recursively call this subroutine.
7. Restore saved values from the stack.
8. Do any remaining computation.
9. Decrement stack pointer.
10. Return.

When you recursively call a subroutine from itself, the variables in the called execution destroy the variables of the same name in the calling execution. To preserve the original values of these variables, save in a dimensioned variable (called a stack) those variables you need to recall later. Suppose your subroutine has three variables (x,y and z) it wishes to save for recall when it returns from a recursive call. The format of the stack dimensioned variable A for this subroutine would be:

A (1) X from execution 1
A (2) Y from execution 1
A (3) Z from execution 1
A (4) X from execution 2
A (5) Y from execution 2
A (6) Z from execution 2
etc.

To keep track of the position in the stack where the current execution saves its values, a pointer is used. This pointer is incremented by the required number, in the above example 3, every time a recursive call is made, and decremented by the same amount on each return.

The general recursive procedure outlined above shows only one recursive call in the subroutine. In general, steps 3 to 8 may be repeated several times before the return at steps 9 and 10.

Let's take a recursive subroutine and see how these steps are implemented. The factorial is the standard first example of recursion – unfortunately, because it also represents a problem where recursion is not the best way to obtain a solution. However, it is the most familiar and simplest of all examples, so why break tradition?

The common definition of N factorial (N!) is iterative:

0! = 1

N! = N* (N-1) * (N-2)*. . .*2*1 for N=1, 2, . . .

But there is also a recursive definition of N factorial:

0! = 1

N! = N * (N-1)! for N=1, 2, . . .

In this case the factorial is defined in terms of itself, but with one escape clause which occurs at 0!. The recursive form of a subroutine to compute N! is:

```
960 REM THIS SUBROUTINE COMPUTES N
    FACTORIAL RECURSIVELY AND
970 REM STORES THE RESULT IN F.
    THE FIRST CALL IS TO 990.
980 REM THIS PROGRAM IS IN RADIO
    SHACK LEVEL I BASIC.
990 S=1
1000 IF N=0 THEN F=1: S=S-1: RETURN
1010 A(S)=N
1020 S=S+1
1030 N=N-1:GOSUB 1000
1040 N=A(S)
1050 F=N*F
1060 S=S-1
1070 RETURN
```

In this program, statement 990 corresponds to step 1 in the general algorithm given earlier. Statement 1000 corresponds to step 2, where the termination condition is N=0. The stack is incremented and decremented by 1 in this program because only one variable, N, is saved when a recursive call is made. No computations in this program correspond to step 3 of the general algorithm, and statements 1010 to 1070 correspond to steps 4 to 10, respectively.

Of course, the simpler iterative version of the factorial subroutine executes much faster:

```
970 REM ITERATIVE SUBROUTINE
    TO COMPUTER N FACTORIAL
980 REM AND STORE IT IN F.
990 REM THIS PROGRAM IS IN
    RADIO SHACK LEVEL I BASIC.
1000 F=1
1010 IF N<=1 THEN RETURN
1020 FOR I=2 TO N
1030   F=F*I
1040 NEXT I
1050 RETURN
```

Another common example of recursion is the computation of the Fibonacci sequence of numbers. The Nth number in the Fibonacci sequence, F(N), is defined in terms of its two predecessors.

F(0) = 0

F(1) = 1

F(N) = F(N-1) + F(N-2) for N = 2, 3, . . .

Your BASIC version of this algorithm is:

```
970 REM SUBROUTINE 990 CALCULATES
    THE NTH FIBONACCI NUMBER
980 REM RECURSIVELY AND RETURNS
    IT IN F. R.S. LEVEL I BASIC.
990 S=1
1000 IF (N=0)+(N=1)
     THEN F=N: S=S-2: RETURN
1010 A(S)=N
1020 S=S+2
1030 N=N-1: GOSUB 1000
1040 N=A(S)
1050 A(S+1)=F
1060 S=S+2
1070 N=N-2:GOSUB 1000
1080 F=A(S+1)+F
1090 S=S-2
1100 RETURN
```

In this example, there are two stack entries for each call level. The Sth entry in A is the value of N for that call level, and the (S+1) st is the value of F(N-1).

Again, as in the case of the factorial, iteration gives a more efficient solution to this problem.

```
970 REM SUBROUTINE 1000 CALCULATES
    THE NTH FIBONACCI NUMBER
980 REM ITERATIVELY AND RETURNS IT IN F.
990 REM IT IS WRITTEN IN RADIO
    SHACK LEVEL I BASIC.
1000 F=1:P=0
1010 FOR I=1 TO N-1
1020   Q=F
1030   F=F+P
1040   P=Q
1050 NEXT I
1060 RETURN
```

Although your first two examples of recursion could be better done iteratively, recursion is the desired technique for many problems because it greatly simplifies the solution algorithm and its implementation in a BASIC program.

Now consider two such problems. The first is the Tower of Hanoi, a well-known problem which is nicely treated in a recursive manner. This problem consists of three pegs, which we will call pegs 1, 2 and 3, and D disks, all of different radius, which can be stacked on the pegs. Initially the disks are stacked on peg 1 in order of decreasing size with the largest disk on the bottom. The problem is to move the disks from peg 1 to peg 2 with the restriction that disks must be moved one at a time from one peg to another, and that no disk may ever be stacked on top of a smaller disk.

The recursive solution generalizes the problem to move D disks from peg E to Peg F by moving the top D-1 disks on peg E to the third peg, moving the one remaining disk on peg E to peg F, and then moving all of the disks on the third peg to peg F. This reduces the problem of moving D disks to two moves of D-1 disks. The recursive algorithm for moving the top D disks from peg E to peg F is:

1. If D=1, move top disk from E to F; return.
2. Let G be the number of the peg which is not E or F.
3. Recursively call this procedure to move the top D-1 disks from E to G.
4. Move the disk on E to F.
5. Recursively call this procedure to move the top D-1 disks from G to F.
6. Return

In our implementation, store the number of disks on peg I in A(I), for I=1, 2, 3. The values that need to be saved when a recursive call is made are E, F and D. Our BASIC version of this algorithm is then:

```
970 REM TOWER OF HANOI SUBROUTINE
    TO MOVE THE TOP D DISCS
980 REM FROM PEG E TO PEG F.
    WRITTEN IN R.S. LEVEL I BASIC.
990 S=4
1000 IF D=1 A(E)=A(E)-1:A(F)=A(F)+1:
     PRINT "MOVE";E;"TO";F:GOTO 1090
1010 G=6-(E+F)
1020 A(S)=E: A(S+1)=F: A(S+2)=D
1030 S=S+3: D=D-1: F=G
1040 GOSUB 1000
1050 E=A(S): F=A(S+1): D=A(S+2)
1060 A(E)=A(E)-1: A(F)=A(F)+1:
     PRINT "MOVE";E;"TO";F
1070 S=S+3: D=D-1: E=6-(E+F)
1080 GOSUB 1000
1090 S=S-3
1100 RETURN
```

Now consider a final useful application of recursion. The quicksort algorithm, – one of the most efficient and widely used sorting algorithms, is very easily programmed recursively.

Suppose we have values stored in A(L), . . ., A(H) and we wish to place the values in ascending order in the same storage locations. The basic quicksort algorithm chooses some arbitrary value from this list, say X=A(K), then rearranges the values so that all values smaller than X are located before it in the list and all values larger than X are located after it. Then X will be at its correct sorted position in the list, say A(I). The same algorithm is then recursively applied with L and I-1 in place of L and H, and then again applied using I+1 and H. When the algorithm is called with L=H, we simply return.

The only part of the algorithm that needs some additional attention is the process of rearranging the list so that X is in its proper position and all other values lie on the proper side of X. Keeping two pointers, I and J, accomplishes this process. I starts by pointing at the first position in the list, L. J points to H. Then pointer I is moved down the list until a value is encountered which is no smaller than X. This value of A(I) should therefore lie below X in the list. Next pointer J is moved up the list until it encounters a number no larger than X. That number is exchanged with A(I), and both are then in the proper part of the list relative to the eventual position of X. The process is repeated until I and J cross. At that point the rearrangement is completed. Figure 1 shows an example of this process.

```
I->12    12    12    12    12    12    12
   75 I->75     3     3     3     3     3
   60    60 I->60 I->60    44    44    44
   13    13    13    13 I->13    13 J->13
X->46 X->46 X->46 X->46 JX->46 IJX->46 X->46
   44    44    44 J->44    60    60 I->60
   94    94    94    94    94    94    94
   49    49    49    49    49    49    49
   95    95 J->95    95    95    95    95
J-> 3 J-> 3    75    75    75    75    75
```

Figure 1

The program to accomplish this process is:

```
960 REM QUICKSORT-SUBROUTINE TO
    REARRANGE A(L) THRU A(H) SO THAT
970 REM ALL VALUES <=X LIE BEFORE X
    AND ALL VALUES >=X LIE AFTER.
980 REM X IS A(INT((L+U)/2). INITIAL
    CALL TO 990 SORTS A(1)-A(N).
990 L=1: H=N:S=N+1
1000 IF L>=H GOTO 1100
1010 M=INT((L+H)/2): X=A(M): I=L: J=H
1020 IF A(I)<X THEN I=I+1: GOTO 1020
1030 IF A(J)>X THEN J=J-1: GOTO 1030
1040 IF I<=J THEN T=A(I):A(I)=A(J):
     A(J)=T:I=I+1:J=J-1
1050 IF I<=J THEN GOTO 1020
1060 A(S)=I:A(S+1)=H
1070 H=J:S=S+2:GOSUB 1000
1080 I=A(S):H=A(S+1)
1090 L=I:S=S+2:GOSUB 1000
1100 S=S-2: RETURN
```

In this program, statement 1000 tests for termination. Statements 1010 to 1050 partition the list into those values smaller than X and those larger than X. The two recursive calls follow statement 1050. Only two values, I and H, are saved during the recursive call.

An illustration of an execution of the quicksort algorithm is given in Figure 2. The original list of ten numbers is found on the far left. The circled numbers are the values used for X, and the number-pairs in rectangles are the values of L and H used to partition the list. Note that we begin with L=1, H=10, X=46. X is then placed by partitioning in the fifth position. Next the process is called for X=3, L=1, H=4 and X=49, L=6, H=10. The process continues in this way until all values are correctly sorted. □

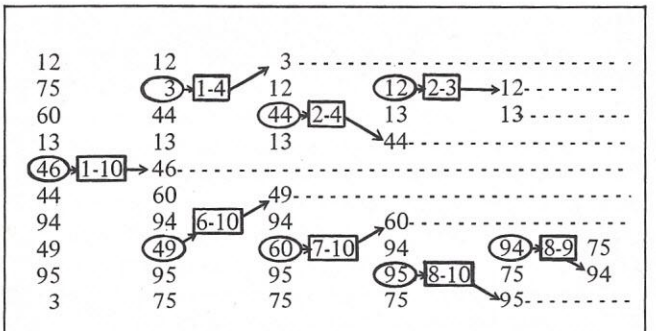

Figure 2

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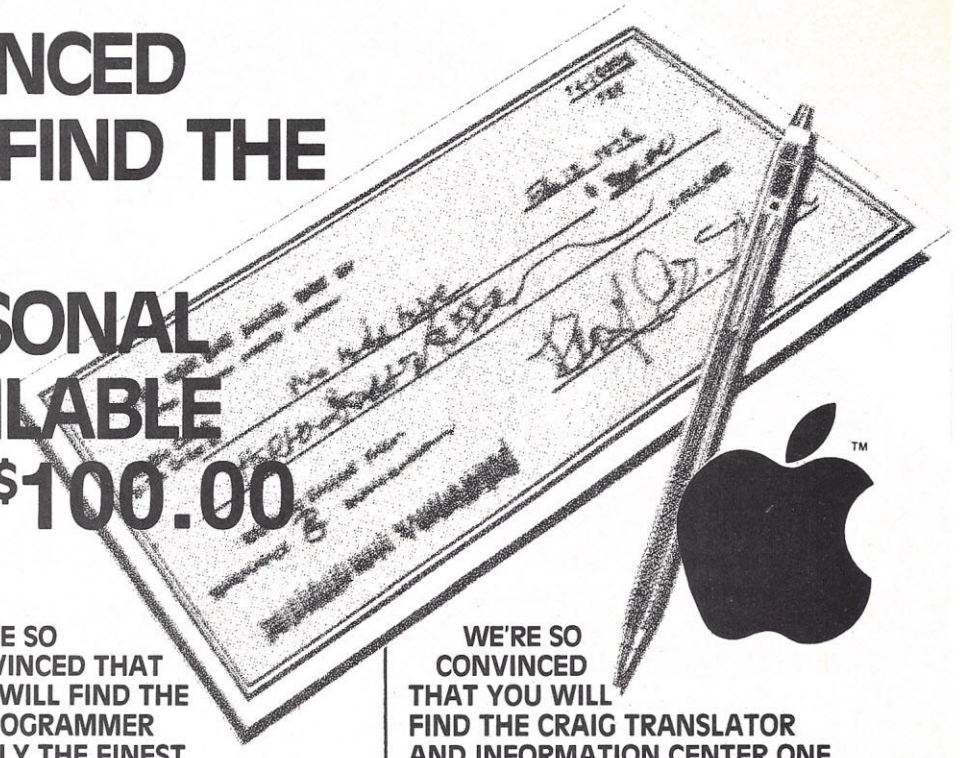

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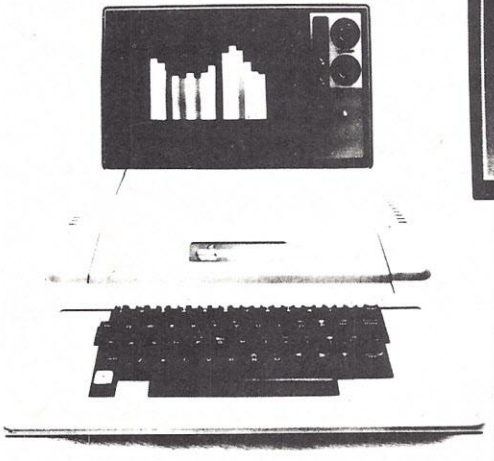

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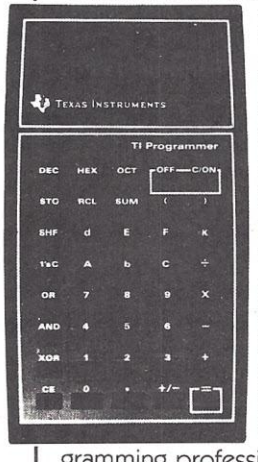

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CIRCLE 9

SMALL BUSINESS COMPUTING

Part 1

TAX BASE

BY PAUL HOLLIDAY

This TAX program files income tax data on a disk so the data can be retrieved conveniently and rapidly whenever desired. In addition, the program can print daily reports or year-end reports to help you prepare income tax forms. The program consists of several individual program modules which perform a variety of functions described in subsequent paragraphs.

The first program, TAX.BAS, provides for creation of a new data base and allows adding new categories or names to the data base directory. In addition, it contains other functions such as deleting a category name and adding a new category name to the data base. The BASIC-E program listing for this module is shown in Program Listing 1.

The second program, TAX2.BAS, contains other supporting functions which include entering new data into the data base and printing various reports of tax data or filing categories. The program listings contain numerous comments and should be read completely since they provide a substantial amount of additional documentation. See Program Listing 2 (contained in Part 2 of this article next month).

Using the Programs

Before using the programs for the first time, you should familiarize yourself with the menus of both program modules. The menu which contains the commands available for program TAX.BAS is shown in Figure 1. The menu for TAX2.BAS is displayed in Figure 2. Inspect the menus and read the functions available. (The functions available are described in more detail later on.)

To load the main program, type RUN TAX followed by [RETURN]. (Note that all entries are followed by the [RETURN] key.) After loading the first program and looking at the menu, exit by typing Q or QUIT. Now load the next program by typing RUN TAX2 [RETURN]. Again, read the menu and try using any of the functions. If you've already created a new data base, or are using the canned files TAXDATA.FIL and TAXDATA.DIR, you can now print or enter data or use any of the other functions. If you're starting from scratch and have not created a data

Part 2 of this article, to be published next month, examines program organization, file structure and error handling routines. In addition, it includes Program Listing 2 (TAX2.BAS), a sample data base and suggestions for modifying and adapting the TAX program package.

```
INCOME TAX DATA BASE PROGRAM, (TAX.BAS  V1.7,19AUG78)
INITIAL FREE BYTES=1113

        ADD     TO ADD NEW CATEGORY TO DATA BASE
        CHANGE  TO CHANGE FILENAMES FOR THIS RUN
        CREATE  TO CREATE OR START NEW FILES
        DELETE  TO DELETE CATEGORY (OR NAME) FROM FILE
        HELP    TO GET MORE INSTRUCTIONS
        LIST    TO LIST A FILE
        OPT     TO SET/CHANGE OPTIONS (SEE .DOC)
        QUIT    TO QUIT OR STOP ANY FUNCTION
        CTRL-C  TO EXIT PROGRAM AND RETURN TO CP/M

TYPE SOMETHING:?
```

Figure 1 Menu for TAX. BAS

```
INCOME TAX DATA BASE PROGRAM, (TAX2.BAS  V0.5,19AUG78)
INITIAL FREE BYTES=2329

        CHANGE  TO CHANGE FILE NAMES FOR THIS RUN
        ENTER   TO ENTER DATA FOR EXISTING CATEGORY
        OPT     TO SET/CHANGE OPTIONS (SEE .DOC)
        PRINT   TO PRINT REPORTS OF TAX DATA
        PRINTC  TO PRINT (LIST) ALL CATEGORY NAMES
        QUIT    TO QUIT OR STOP ANY FUNCTION
        CTRL-C  TO EXIT PROGRAM AND RETURN TO CP/M

TYPE SOMETHING:? QUIT
```

Figure 2 Menu for TAX2.BAS

base, then you must create one using the CREATE command in program TAX.BAS.

Creating a New Data Base

To create a new data base, type RUN TAX. When the menu appears, type CREATE. Follow the prompts and enter your categories and data as requested by the program. When finished, type DONE. If you make a mistake, enter CTRL-U (CONTROL and U keys depressed simultaneously) to erase the entire line or RUBOUT to erase and echo the last character. You can also type Q or QUIT to abort the run.

The format of the data records as they would appear in a handwritten log would look like Figure 3A. The computer representation of this log is shown in Figure 3B. Note that for the manually kept log in Figure 3A, the TOTAL column must be manually updated by the user as each entry is made. For the computer version (or data base) the TOTAL column is calculated and updated automatically by the program each time an entry is made.

Language and Minimum System Requirements

Both programs are written in BASIC-E and require a minimum of 24K of RAM, the CP/M disk operating system and one floppy disk. However, a large portion of the programs is devoted to duplicate code (structured programming). You can run them on a much smaller system if duplicate code and REM statements are eliminated.

CP/M Interface and Related Codes

The following codes are essentially part of the CP/M disk operating system and can be used as necessary:

CTRL-C—Terminates program and returns to DOS

CTRL-R — Re-types current command line without rubouts

CTRL-S — Freezes printing; hit any other character to continue

CTRL-U — Cancels the current line being entered

CTRL-X — Same as CTRL-U

CTRL-Z — Exit to DOS

RUBOUT — Delete and echo the last character typed

Data Entry

When entering data, observe the following rules:

- Don't use commas. Use a space or dash if necessary.
- Use CTRL-U to erase entire entry (or line).

INCOME TAX REFUNDS RECEIVED 1978

DATE	DESCRIPTION	AMOUNT	CUMUL. TOTAL
31JUL78	CHECK REC'D ADJUSTMENT/REFUND CHECK	101.00	101.00
-	Above was Federal OI refund, ACTUAL 102.58	1.58	102.58
31JUL78	Federal refund for 1976 OI	65.01	167.59
21AUG78	Federal refund for 1975 OI	24.30	191.89

Figure 3A Handwritten log example of data record format

```
DATA BASE TITLE = INCOME TAX DATA 1978

INCOME TAX REFUNDS RECEIVED

DATE      DESCRIPTION                          AMOUNT     TOTAL
-------   ---------------------                ------     -----
31JUL78   CHECK REC'D ADJUSTMENT/REFUND/CREDI  $101       $101
-         ACTUALLY REC'D CHECK FOR 102.58      $1.58      $102.58
31JUL78   ADJUSTMENT (ACTUAL AMT RECD)         $65.01     $167.59
21AUG78   ANOTHER REFUND? (INTEREST?) FROM FR  $24.3      $191.89
```

Figure 3B Computer representation of data record

```
ADD - ADDS A NEW CATEGORY TO THE DATA BASE

DATA FILE NAME IS........ TAXDATA.FIL
DIRECTORY FILE NAME IS... TAXDATA.DIR


ENTER TODAYS DATE:? 22AUG78


FILING CATEGORY (OR NAME):? INCOME TAX REFUNDS RECEIVWED#
#
INCOME TAX REFUNDWW#
INCOME TAX REFUNDS RECEICEVED#
INCOME TAX REFUNDS RECEIVED

ADDED: INCOME TAX REFUNDS RECEIVED

FILING CATEGORY (OR NAME):? DONE

ADD TO DIRECTORY FINISHED, ENTER ANYTHING TO CONTINUE:?
```

Figure 4A Sample run using ADD command

- Use RUBOUT to delete and echo the last character typed.
- To abort at anytime, enter: Q, QUIT, STOP, or CTRL-C.
- To end or stop any function, type DONE. This command is the normal termination or end of any function.
- DESCRIPTION entries are truncated after 35 characters. To change this limit, see MAXDESCR=35 in both program listings.

Name or Category Entries

An asterisk (*) after a name or category entry allows searching for only the first part of a long category or name. For example, if you want to enter data for BOOKS AND EDUCATIONAL, you can enter the name as BOOKS*. The search will stop at the first occurrence of the string BOOKS.

Note that if the category BOOKS FOR

CHARITY was in the directory before the desired one, then BOOKS FOR CHARITY would be printed and/or selected for data entry.

Description of Functions

The following functions and commands are arranged in alphabetic order. For the actual location of the function within the program(s), consult the menus in Figures 1 and 2, and Program Listings 1 and 2.

ADD — The ADD function is used to add a new category or filing name to the data base. Sample runs are provided in Figures 4A and 4B. In Figure 4A, several data entry errors were made to demonstrate the use of the RUBOUT, CTRL-U, and CTRL-R codes, which are part of the DOS.

When the new name or category is entered, only the data base directory is updated. That is, the first record pointer on the directory record is zero and does not point to any record in the random data file (see Figure 11 in Part 2). Data entry for this new category is done using the ENTER command. This method allows you to build a large data base with many categories very rapidly. It also lends itself to creating experimental data bases without using up disk space with random file data records.

CHANGE — The CHANGE command changes file names for the run. A sample run is shown in Figure 5. The default file names are set at TAXDATA.DIR and TAXDATA.FIL for the data base directory and random data files, respectively. If a new file name is entered, the directory file name is defined as a subset of the entered file name, but with file type .DIR. For example, if you entered a new file name of DATABASE, then the files that would be opened or used would be DATABASE and DATABASE.DIR.

Note that it is not necessary to use a file name with file type .FIL. This is only a convention used to make it easier to find and reference files written or read by this program. The CHANGE command does not open or create any disk files. Only the file names used by the program for this run are changed.

CREATE — To create a new data base, enter the command CREATE. If a file with the same name exists on the disk, it will be destroyed and replaced by the new file if creation of the new data base is completed. This command should be used in conjunction with the ADD command to build large data bases.

Note that it is not necessary to build a large data base in one sitting. Additions

```
ADD - ADDS A NEW CATEGORY TO THE DATA BASE
DATA FILE NAME IS..... TAXDATA.FIL
DIRECTORY FILE NAME IS... TAXDATA.DIR

ENTER TODAYS DATE:? 23AUG78

FILING CATEGORY (OR NAME):? BETA
ADDED: BETA

FILING CATEGORY (OR NAME):? DELTA
ADDED: DELTA

FILING CATEGORY (OR NAME):? DONE
ADD TO DIRECTORY FINISHED, ENTER ANYTHING TO CONTINUE:?
```

Figure 4B Sample run using ADD command

```
CHANGE - ALLOWS CHANGING FILE NAMES

DEFAULT FILE NAME IS NOW: TAXDATA.FIL
NEW FILE NAME (OR SPACE FOR NO CHANGE)? NAMES.FIL

FILE NAME IS: NAMES.FIL
IS THIS CORRECT (Y OR N)? Y

DATA FILE NAME IS..... NAMES.FIL
DIRECTORY FILE NAME IS.. NAMES.DIR
ENTER ANYTHING TO CONTINUE:?
```

Figure 5 Sample run using CHANGE command

```
CREATE - CREATES A NEW DATA FILE AND DIRECTORY,

** DATA BASE NAME SELECTION AND INPUT **

NEW FILE CREATION.
ENTER TODAYS DATE IN THE FORM:05AUG78? 23AUG78

ENTER TITLE OR DESCRIPTION OF FILE:? TEST AND EXAMPLE

DEFAULT FILE NAME IS NOW: TAXDATA.FIL
NEW FILE NAME (OR SPACE FOR NO CHANGE)? DATABASE

FILE NAME IS: DATABASE
IS THIS CORRECT (Y OR N)? Y

DATA FILE NAME IS..... DATABASE
DIRECTORY FILE NAME IS... DATABASE.DIR

DATA FORM LOOKS LIKE:

DATE     DESCRIPTION                          AMOUNT    TOTAL
-------  -------------------                  ------    -----

ENTER FILING CATEGORY (NAME) OR 'DONE'? ALPHA

DATE .....? 23AUG78

DESCRIPTION ...? THIS IS A TEST AND EXAMPLE

AMOUNT (COST)..? 0


ENTER FILING CATEGORY (NAME) OR 'DONE'? DONE


FINISHED BUILDING NEW DATA BASE..
RECORDS ADDED=1
ENTER ANYTHING TO CONTINUE:?
```

Figure 6 Sample run using CREATE command

```
DELETE FROM FILE,

DATA FILE NAME IS........ TAXDATA.FIL
DIRECTORY FILE NAME IS... TAXDATA.DIR

ENTER CATEGORY OR NAME TO BE DELETED:? DELTA

SEARCHING FOR 'DELTA'
UPDATING DIRECTORY..
DIRECTORY UPDATED, 1 RECORD(S) DELETED FROM DIR.

DELETE FINISHED, ENTER ANYTHING TO CONTINUE:?
```

Figure 6A Sample run using DELETE command

```
ENTER - USED TO ENTER DATA FOR EXISTING CATEGORY

WHAT IS CATEGORY OR NAME DESIRED? MISC

SEARCHING DIRECTORY 'TAXDATA.DIR'

EXISTING CATEGORY NAMES FOR 'TAXDATA.DIR' ARE...
 1 . AUTO INSURANCE
 2 . AUTO LICENSE FEES
 3 . BOOKS AND EDUCATIONAL
 4 . CHILD SUPPORT
 5 . CONTRIBUTIONS
 6 . DENTIST
 7 . DIVIDENDS AND INTEREST
 8 . DOCTORS
 9 . DRUGS
10 . EDUCATION EXPENSES
11 . GLASSES AND EYE EXAMINATIONS
12 . GRUMMAN STOCK
13 . INCOME TAX PREPARATION
14 . IRA
15 . LICENSE FEES
16 . MAJOR PURCHASES
17 . MEDICAL EXPENSES
18 . MEDICINE AND DRUGS
19 . MISC

MISC

DATE     DESCRIPTION                          AMOUNT     TOTAL
-------  -----------------------              ------     -----

FIRSTRECORDX=0
DATE ..........? 24MAR78

DESCRIPTION ...? MILEAGE TO OTP 20MI/WK--=800 MI#
MILEAGE TO OTP 20MI/WK=800 MI

AMOUNT (COST)..? 120

24MAR78  MILEAGE TO OTP 20MI/WK=800 MI        $120       $120
DATE ..........? DONE


DIRECTORY UPDATE REQUIRED..
UPDATING 'MISC' ON SCRATCH
NOW UPDATING DIRECTORY..
DIRECTORY UPDATED..


DONE WITH DATA ENTRY, ENTER ANYTHING TO CONTINUE:?
```

Figure 7 Sample run using ENTER command

and entries can be made at leisure or when you feel like it. For example, the data base shown in the Sample Run (in Part 2), which is the start of my 1978 income tax data base, was built (entered) over a period of several weeks. See Figure 6 for a sample run using the CREATE command.

DELETE — This command deletes a category (or filing name) from the data base directory. A sample run is shown in Figure 6A. Note that for this version, only the name is deleted from the directory and the data file (.FIL) is not erased. That is, the data records and all pointers remain in the random data file. Modified versions of this program could delete these records to provide more room for data storage. However, it appears that a full size disk accommodates a year's worth of data without difficulty, and it may not be worth the extra overhead to add a garbage collection algorithm.

ENTER — The ENTER command is used to enter data for a category name which already exists in the directory. See Figure 7 for a sample run using the ENTER command. In this example, the directory will be searched for the name MISC. The existing category names are printed as the search proceeds. (This feature can be inhibited by setting LISTDIR=0 using the OPT command.) When the name is found, a title line or header is printed along with any existing data for the category. If no data was entered, the program prints FIRSTRECORDX=0 and prompts you for the date, description and amount. After entering the data (any number of entries can be made), type DONE to terminate the run. In this example, the directory will also be updated since the first record pointer was zero.

HELP — This command responds with a printout of some very basic information concerning data entry and other info. Due to memory limitations, only minimal information is provided.

LIST — The LIST command, a debugging tool for the programmer, provides a means of displaying the contents of both the directory file and the random data file. The Sample Run in Part 2 uses the LIST command and shows a typical data base directory and data file. In this example, the data base was titled INCOME TAX DATA 1978 and consisted of 31 directory records (30 categories) and 40 random data records (39 data entry records). See Figure 11 (in Part 2) for file organization and compare with the printout in the Sample Run.

OPT — The OPT or options command

allows changing the default option flags set when the program is compiled. At present, only three flags or options are present. In Figure 8, the current settings of the options are printed and the operator is prompted for input. Enter a 0 to turn the option off, and a 1 to turn it on. The flag TEST is used to print messages whenever a disk file is read or written. It is set to 0 as the default option because it results in a large number of messages being printed. Set FLAG=1 if you want to know when each file access occurs. The flag PRINTER is normally set to 1. Set it to 0 to inhibit printer output commands such as PRINT CHR$(PAGE). If you don't have a printer, the printer output commands in the program may cause you trouble. The LISTDIR flag controls the automatic listing of the directory. If it is set to 1, the directory will be listed whenever a search is initiated using the ENTER command. To speed up the search, set LISTDIR=0. After you enter the options, the new values are listed before exiting from the routine.

```
TYPE SOMETHING:? OPT


OPTIONS SELECTION..,

TEST=0
PRINTER=1
LISTDIR=1

TEST FLAG (0 OR 1)? 0

PRINTER (0 OR 1)? 0

LIST DIRECTORY (0 OR 1)? 1


TEST=0
PRINTER=0
LISTDIR=1

ENTER ANYTHING TO CONTINUE:?
```

Figure 8 Sample run using OPT command

PRINT — The PRINT command allows you to print reports of a single category. A sample run is shown in Figure 9. In this example, the category BOOKS AND EDUCATIONAL was listed. You are prompted for the category name to be found and printed. If you don't remember the names, use the PRINTC command to print the current directory. Note that you can enter a shorter name than is actually used for the category; See "Name or Category Entries" for how to do this.

PRINTC — This command lists all categories or names in the current directory file for the data base. A sample run using the PRINTC function is shown in Figure 10. This command is useful if you forget what category names you have or if you want to print an index of the categories for a hard copy. The listing is halted every 15 lines to allow for video screen viewing of the items. Enter a space or any character to continue the listing. □

```
PRINT - PRINTS REPORTS OF TAX DATA FILES

USE 'OPT' TO TURN PRINTER ON OR OFF,

WHAT IS CATEGORY OR NAME DESIRED? BOOKS AND EDUCATIONAL

SEARCHING DIRECTORY FOR: 'BOOKS AND EDUCATIONAL'

*
*******
MAKE PRINTER READY, ENTER ANYTHING TO CONTINUE:?

DATA BASE TITLE = INCOME TAX DATA 1978

BOOKS AND EDUCATIONAL

DATE     DESCRIPTION                          AMOUNT    TOTAL
-------  -----------------------              ------    -----
25JAN78  ENCYCLOPEDIA OF COMPUTER SCIENCE     $0        $0
25JAN78  MICROCOMPUTER HANDBOOK (SIPPL)       $17.38    $17.38
25JAN78  ABOVE FROM LIBRARY OF COMP AND INFO  $0        $17.38
30JAN78  FUNDAMENTALS OF FORECASTING-SYSTMS   $16.47    $33.85
05MAR78  8080/8085 ASSEMBLY MANUAL-OSBORNE    $7.99     $41.84
16APR78  MICROCOMPUTER DICTIONARY-LIB OF COM  $11.58    $53.42
29APR78  ENCYCLOPEDIA OF ELECTRONIC CIRCUITS  $3.55     $56.97
04MAR78  PERIODICAL GUIDE- E.BERG (BAC 5/78)  $5        $61.97
29MAY78  VNR MATH ENCYCLOPEDIA                $14.95    $76.92
06JUN78  PERSONAL COMPUTING DIGEST NCC 78     $8        $84.92
06JUN78  BASIC COMPUTER GAMES (BOOK)          $7.5      $92.42
07JUL78  5 BOOKS LIB OF COMP AND INFO SCIENC  $24.04    $116.46


FINISHED WITH 'PRINT'..
ENTER ANYTHING TO CONTINUE:?
```

Figure 9 Sample run using PRINT command

```
PRINTC - PRINTS OR LISTS ALL CATEGORIES IN DIRECTORY

USE 'OPT' TO TURN PRINTER ON OR OFF,
USE 'CTRL-S' TO STOP LISTING

ENTER ANYTHING TO CONTINUE:?

*
*******
MAKE PRINTER READY, ENTER ANYTHING TO CONTINUE:?


DATA BASE TITLE = INCOME TAX DATA 1978
EXISTING CATEGORY NAMES FOR 'TAXDATA.DIR' ARE...

 1 . AUTO INSURANCE
 2 . AUTO LICENSE FEES
 3 . BOOKS AND EDUCATIONAL
 4 . CHILD SUPPORT
 5 . CONTRIBUTIONS
 6 . DENTIST
 7 . DIVIDENDS AND INTEREST
 8 . DOCTORS
 9 . DRUGS
10 . EDUCATION EXPENSES
11 . GLASSES AND EYE EXAMINATIONS
     ENTER ANYTHING TO CONTINUE:?
12 . GRUMMAN STOCK
13 . INCOME TAX PREPARATION
14 . IRA
15 . LICENSE FEES
16 . MAJOR PURCHASES
17 . MEDICAL EXPENSES
18 . MEDICINE AND DRUGS
19 . MISC
20 . MOTORCYCLE INSURANCE
21 . PROFESSIONAL ASSOCIATION DUES
22 . PROFESSIONAL PUBLICATIONS
23 . REGISTRATION FEES
24 . SALES TAX
25 . SAVINGS INTEREST
     ENTER ANYTHING TO CONTINUE:?
26 . STOCK
27 . TAXES
28 . TECHNICAL PUBLICATIONS
29 . TOOLS
30 . VISITATION

FINISHED WITH 'PRINTC', ENTER ANYTHING TO CONTINUE:?
```

Figure 10 Sample run using PRINTC command

Program Listing 1 – TAX.BAS

```
REM ------------------------------------------------
REM -                 TAX.BAS                      -
REM -               (BASIC-E)                      -
REM ------------------------------------------------
REM
PROGNAME$="TAX.BAS"
VERSION$="V1.7,19AUG78"
REM
REM ------------------------------------------------
REM THE PURPOSE OF THIS PROGRAM IS TO.....
REM     1. FILE DAILY INCOME TAX DATA ON DISK.
REM     2. CREATE A NEW DATA AND DIRECTORY FILE.
REM     3. ADD NEW CATEGORIES TO DIRECTORY.
REM     4. DELETE AN ITEM OR CATEGORY.
REM        (SEE TAX2.BAS FOR MORE FUNCTIONS)
REM
REM PAUL HOLLIDAY
REM WRITTEN IN BASIC-E ON CP/M DISK.
REM CP/M-RAM SIZE = 24K
REM ORIGINAL PROGRAM STARTED 29JUL78.
REM BASELINE WAS: MILEAGE.BAS V3.6,27JUL78
REM IF ONLY 24K CPM, DONT USE $E OPTION.
REM MAKE SURE AT LEAST 800+ FREE BYTES AT RUN TIME
REM
REM INTERFACING OR RELATED PROGRAMS.....
REM     TAX2.BAS        SUBSET OF THIS PGM,OTHER STUFF
REM     TAXDATA.FIL     DATA FILE CREATED/USED BY PGM
REM     TAXDATA.DIR     DIRECTORY (POINTERS TO DATA)
REM
REM ------------------------------------------------
REM
REM ----- STRING DATA AND DEFAULT FILE NAMES -----
DEFAULT1$="TAXDATA.DIR" :REM DIRECTORY FILE DEFAULT NAME
DEFAULT2$="TAXDATA.FIL" :REM DATA FILE DEFAULT NAME
DEFAULTNAME$=DEFAULT2$  :REM CURRENT DATA FILE DEFAULT
DUMMY$="DUMMY REC"      :REM GENERAL STRING DUMMY
FILENAME$=DEFAULT2$     :REM CURRENT FILE NAME
FILENAME1$=DEFAULT1$    :REM DIRECTORY FILE NAME
FILENAME2$=DEFAULT2$    :REM DATA FILE NAME
REM
REM ----- VARIABLES AND CONSTANTS (INITIAL VALUES) -----
CTLD=4          :REM CTRL-D CHARACTER
CTLQ=17         :REM CTRL-Q CHARACTER
CTLS=19         :REM CTRL-S CHARACTER
DFLAGX=0        :REM SET 'RECORD DELETED' FLAG=0
DUM=0           :REM NORMAL VALUE OF NUMERIC DUMMY
DUMX=DUM        :REM NUMERIC DUMMY WRITTEN/READ ON FILES
MAXDESCR=35     :REM MAX CHARS ALLOWED FOR DESCRIPTION
ONCE=0          :REM FIRST TIME THRU FLAG
PRINTER=1       :REM PRINTER OPTION=1 IF AVAILABLE
RSIZE=256       :REM SIZE OF RANDOM ACCESS RECORDS
STOPFLAG=1      :REM 1=STOP AFTER LISTING EACH RECORD
TEST=0          :REM TEST FLAG FOR DEBUG ALLOWS PRINTS
TYPE1=1         :REM TYPE 1 RECORD=HEADER
TYPE2=2         :REM TYPE 2 RECORD=DATA RECORD
TYPE3=3         :REM TYPE 3 RECORD=(UNDEFINED)
TYPEX=0         :REM RECORD TYPE READ/WRITTEN ON FILE
REM
REM ------------------------------------------------
REM -   CONSOLE OR HARDWARE DEPENDENT EQUATES    -
REM ------------------------------------------------
CLEAR=CTLD      :REM VECTOR 1 CLEAR SCREEN CODE
PAGE=CTLQ       :REM PAGE SKIP CODE FOR PRINT (CPMLINO)
SPEED=CTLS      :REM VECTOR 1 VIDEO SPEED CONTROL CODE
REM
REM ----- SIGN ON AND IDENTIFY PROGRAM -----
GOSUB 5000      :REM CLEAR SCREEN, SET SPEED
REM PRINT OF PROGRAM NAME AND VERSION DELETED BECAUSE
REM IT IS NOW IN MENU HEADER LINE (SEE BELOW)
REM
REM
100 REM ----- RESUME, ENTRY AFTER DONE OR ERROR -----
REM
FOR MENULOOP=1 TO 1 STEP 0
REM
REM ----- FLAGS AND VARIABLES RESET ON RETRY -----
ADDCNT=0        :REM 'RECORDS ADDED..' COUNTER
ADDFLAG=0       :REM ADD RECORDS FLAG WORD
BLENGTH=RSIZE   :REM BLOCK LENGTH USED TO OPEN FILES
CREATEFLAG=0    :REM CREATE NEW FILE FLAG WORD
EDITFLAG=0      :REM EDIT FLAG WORD
FILENMBR=1      :REM CURRENT FILE NUMBER IN USE
```

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CIRCLE 12

Program Listing 1 continued

```
LISTFLAG=0       :REM LIST FLAG WORD
MENUFLAG=0       :REM MAIN MENU FLAG =0 IF ILLEGAL
NEWFILE=0        :REM NEW FILE OPENED FLAG=0
NEWFLAG=0        :REM NEW FILE REQUEST FLAG WORD
NOCLOSE=1        :REM DONT CLOSE AFTER EACH READ/WRITE
OPENED=0         :REM NUMBER OF FILES OPENED COUNTER
RECNMBR=2        :REM INITIAL DATA RECORD NMBR TO READ
RNMBR=1          :REM RECORD NUMBER WRITTEN ON EACH BLK
RCNT=1           :REM RECORD COUNT,SAVED ON RECORD #1
REM
IF ONCE>0 THEN GOSUB 5000       :REM CLEAR SCREEN
PRINT"INCOME TAX DATA BASE PROGRAM, ";
PRINT"(";PROGNAME$;"  ";VERSION$;")"
IF ONCE=0 THEN PRINT"INITIAL FREE BYTES=";FRE
REM IF ONCE>0 THEN 300 :REM MENU BYPASS NOP'D
PRINT
REM ----- PRINT USER SELECTION MENU -----
TAB1=10          :REM TAB TO SPACE MENU OVER TO CENTER
PRINT TAB(TAB1);
PRINT"ADD      TO ADD NEW CATEGORY TO DATA BASE"
PRINT TAB(TAB1);
PRINT"CHANGE   TO CHANGE FILENAMES FOR THIS RUN"
PRINT TAB(TAB1);
PRINT"CREATE   TO CREATE OR START NEW FILES"
PRINT TAB(TAB1);
PRINT"DELETE   TO DELETE CATEGORY (OR NAME) FROM FILE"
PRINT TAB(TAB1);
PRINT"HELP     TO GET MORE INSTRUCTIONS"
PRINT TAB(TAB1);
PRINT"LIST     TO LIST A FILE"
PRINT TAB(TAB1);
PRINT"OPT      TO SET/CHANGE OPTIONS (SEE .DOC)"
PRINT TAB(TAB1);
PRINT"QUIT     TO QUIT OR STOP ANY FUNCTION"
PRINT TAB(TAB1);
PRINT"CTRL-C   TO EXIT PROGRAM AND RETURN TO CP/M"
ONCE=1           :REM SET 'FIRST TIME THRU' FLAG
REM
300 REM          :REM BYPASS MENU FROM ABOVE
REM INSERT PRINT"ADD,CREATE,...ETC IF MENU BYPASSED
PRINT
PRINT"TYPE SOMETHING: ";
GOSUB 9202       :REM INPUT ALPHA,CHECK FOR QUIT
IF A$="ADD"      THEN GOSUB 1000
IF A$="CHANGE"   THEN GOSUB 1700
IF A$="CREATE"   THEN GOSUB 1400
IF A$="DELETE"   THEN GOSUB 1800
IF A$="ENTER"    THEN GOSUB 3010
IF A$="HELP"     THEN GOSUB 1200
IF A$="LIST"     THEN GOSUB 1300
IF A$="OPT"      THEN GOSUB 1600
IF A$="QUIT"     THEN 9900
IF LEFT$(A$,1)="Q" THEN 9900
PRINT
IF MENUFLAG=0 THEN \
        PRINT"ILLEGAL ENTRY....." :\
        FOR I=1 TO 200 :\
        NEXT I
NEXT MENULOOP
REM
REM
REM ------------------------------------------------
REM -                FUNCTIONS                     -
REM ------------------------------------------------
REM
REM FNR2(X) - ROUNDS A NUMBER TO 2 DECIMAL PLACES.
REM 100=10^D=10^2 (WHERE D= # OF DECIMAL PLACES)
DEF FNR2 (X) = INT(X*100+0.5)/100
REM
REM ------------------------------------------------
REM -             MAIN SUBROUTINES                 -
REM ------------------------------------------------
REM
1000 REM ---------------
REM      -     ADD     -
REM      ---------------
REM ADDS A NEW CATEGORY TO THE DATA BASE
GOSUB 5000       :REM CLEAR SCREEN. SET SPEED
PRINT"ADD - ADDS A NEW CATEGORY TO THE DATA BASE"
PRINT
ADDFLAG=1        :REM SET 'ADD IN PROGRESS..' FLAG
ADDCNT=0         :REM RECORDS ADDED COUNTER=0
GOSUB 7860       :REM PRINT CURRENT FILE NAMES
PRINT
REM
REM ----- OPEN DIRECTORY FILE AND READ HEADER -----
IF END #1 THEN 9000
GOSUB 7050       :REM SETUP,OPEN FILE,READ DIR HEADER
REM
REM ----- READ REST OF DIRECTORY -----
FILENMBR=1
IF END # FILENMBR THEN 1010
FOR ADDLOOP=1 TO 1 STEP 0
GOSUB 6130       :REM READ DIRECTORY DATA RECORDS
NEXT ADDLOOP
REM
REM
1010 REM END OF DIRECTORY RECORDS
REM
PRINT
PRINT"ENTER TODAYS DATE: ";
GOSUB 9202       :REM INPUT ALPHA,CHECK FOR QUIT
IF A$="DONE" THEN 1050
DATE2X$=A$       :REM SET DATE OF CATEGORY CREATION
REM
REM ---- SETUP TO WRITE ON TAXDATA.DIR -----(WAS SCR)
FILENMBR=1       :FILENAME$=FILENAME1$
REM
REM ----- LOOP AND INPUT,WRITE ON TAXDATA.DIR -----
PRINT
FOR ADDLOOP2=1 TO 1 STEP 0
PRINT"FILING CATEGORY (OR NAME):";
GOSUB 9202       :REM INPUT ALPHA,CHECK FOR QUIT
IF A$="DONE" THEN 1050
ITEMNAMEX$=A$    :REM SET CATEGORY/ITEM NAME
RNMBRX=RNMBRX+1  :REM NEXT RECORD NUMBER
FIRSTRECORDX=0   :REM POINTER TO DATA=0 FOR 'NO DATA'
IF END # FILENMBR THEN 9000
GOSUB 6120       :REM WRITE NEXT DIRECTORY RECORD
PRINT"ADDED: ";ITEMNAMEX$
PRINT
NEXT ADDLOOP2
REM
1050 REM ENTRY IF 'DONE' WAS TYPED
REM
1060 REM
GOSUB 6095       :REM CLOSE ALL OPENED FILES
REM
PRINT
PRINT"ADD TO DIRECTORY FINISHED, ";
GOSUB 9220       :REM ENTER ANYTHING TO CONTINUE
REM MUST USE GOTO AND NOT RETURN BECAUSE OF 'IF END..'
GOTO 100
REM ......... END OF 'ADD' FUNCTION .........
REM
REM
1100 REM SEE TAX2.BAS
1200 REM ---------------
REM      -     HELP    -
REM      ---------------
REM PRINT INSTRUCTIONS OR MORE INFO
GOSUB 5000       :REM CLEAR SCREEN
PRINT"HELP - HERE ARE SOME INSTRUCTIONS."
MENUFLAG=1       :REM SET FLAG FOR LEGAL COMMAND
PRINT
PRINT"USE DIR (DIRECTORY) TO SEE FILES."
GOSUB 5010       :REM PRINT
GOSUB 5020       :REM PRINT
GOSUB 5030       :REM PRINT
PRINT
GOSUB 9220       :REM ENTER ANYTHING TO CONTINUE
RETURN
REM
1300 REM ---------------
REM      -     LIST    -
REM      ---------------
REM
GOSUB 5000       :REM CLEAR SCREEN
PRINT"LIST - LISTS FILES."
LISTFLAG=1       :REM SET 'LIST IN PROGRESS..' FLAG
PRINT
PRINT"LIST OF '";FILENAME1$;"'";" AND '";FILENAME2$;"'"
PRINT
GOSUB 9220       :REM ENTER ANYTHING TO CONTINUE
PRINT
PRINT"***** LIST DIRECTORY RECORDS *****"
FILENMBR=1       :REM FILE NUMBER=1 FOR DIRECTORY
IF END # FILENMBR THEN 1330
GOSUB 7050       :REM SETUP,OPENFILE,READ DIRECTRY HEADER
PRINT
NUMBER=1         :REM RECORD NUMBER COUNTER
PRINT"#";NUMBER
GOSUB 7800       :REM PRINT SEQUENTIAL HEADER RECORD
REM
FOR LISTLOOP=1 TO 1 STEP 0
GOSUB 6130       :REM READ DIRECTORY RECORD (2-N)
NUMBER=NUMBER+1  :REM NEXT RECORD NMBR FOR PRINT
PRINT"#";NUMBER
GOSUB 7805       :REM PRINT SEQUENTIAL DATA RECORD
GOSUB 9220       :REM ENTER ANYTHING TO CONTINUE
NEXT LISTLOOP
1330 REM ENTERS HERE FROM END OF FILE READING DIR.
PRINT
PRINT"END OF DIRECTORY LISTING....."
GOSUB 9220       :REM ENTER ANYTHING TO CONTINUE
REM
PRINT
PRINT"** LISTING OF DATA FILE: ";FILENAME2$;" **"
FILENMBR=2       :FILENAME$=FILENAME2$
GOSUB 6050       :REM OPEN RANDOM FILE
GOSUB 6210       :REM READ RANDOM FILE HEADER RECORD
PRINT"LAST RANDOM FILE RECORD IS: ";RCNTX
INPUT"FIRST RECORD # TO LIST=";A
GOSUB 9200       :REM CHECK FOR QUIT
STARTREC=A       :REM SET STARTING RECORD NUMBER
IF STARTREC < 1 THEN STARTREC=1 :REM SET MINIMUM
```

```
PRINT"LAST RECORD TO LIST=";
GOSUB 9201      :REM INPUT NUMERIC,CHECK FOR QUIT
STOPREC=A       :REM SET LAST RECORD NUMBER
IF STOPREC>RCNTX THEN STOPREC=RCNTX
STOPFLAG=1      :REM SET FLAG TO STOP AFTER EACH REC.
PRINT"DO YOU WANT TO STOP AFTER EACH RECORD (Y OR N)";
GOSUB 9202      :REM INPUT ALPHA,CHECK FOR QUIT
IF LEFT$(A$,1)="N" THEN STOPFLAG=0 :REM DONT STOP
PRINT
IF PRINTER=1 THEN PRINT"MAKE PRINTER READY..., ";\
      :GOSUB 9220     :REM ENTER ANYTHING TO CONT.
GOSUB 5000      :REM CLEAR SCREEN
IF PRINTER=1 THEN PRINT CHR$(PAGE) :REM SKIP TO TOP OF PAGE
PRINT"LISTING OF: ";FILENAME$;" FILE.."
PRINT"FROM RECORD #";STARTREC;
PRINT"TO RECORD #";STOPREC
PRINT
REM IF START RECORD =1 THEN PRINT HEADER RECORD
IF STARTREC=1 THEN GOSUB 7810\
      :STARTREC=STARTREC+1
IF STOPREC<=1 THEN 1350
IF STARTREC>STOPREC THEN STARTREC=STOPREC
REM IF STOPFLAG=1 THEN WAIT FOR OPERATOR ENTRY
IF STOPFLAG=1 THEN GOSUB 9220
FOR I = STARTREC TO STOPREC
RECNMBR=I       :REM RECORD # TO READ
GOSUB 6230      :REM READ RANDOM FILE DATA RECORD
GOSUB 7815      :REM PRINT CONTENTS OF DATA RECORD
IF STOPFLAG=1 THEN GOSUB 9220 :REM WAIT FOR ENTRY
NEXT I
1350 REM        :REM ENTRY FROM ABOVE WHEN RECORD=1
PRINT
PRINT"END OF LIST FOR FILE NAMED: ";FILENAME$
GOSUB 9220      :REM ENTER ANYTHING TO CONTINUE
GOSUB 6095      :REM CLOSE ALL OPENED FILES
LISTFLAG=0      :REM RESET LIST IN PROGRESS FLAG
MENUFLAG=1      :REM SET FLAG TO BYPASS 'ILLEGAL'
GOTO 100        :REM RESUME AT MENU (CANT USE RETURN!!)
REM
1400 REM ---------------
REM      -    CREATE   -
REM      ---------------
REM CREATES A NEW DATA FILE AND DIRECTORY
REM
GOSUB 5000      :REM CLEAR SCREEN
PRINT"CREATE - CREATES A NEW DATA FILE AND DIRECTORY,"
PRINT
ADDCNT=0        :REM RESET 'RECORDS ADDED..' COUNTER
CREATEFLAG=1    :REM SET 'CREATING NEW FILE..' FLAG
MENUFLAG=1      :REM SET FLAG SO DONT GET 'ILLEGAL'
NEWFLAG=1       :REM SET 'NEW FILE..' FLAG
REM
PRINT"** DATA BASE NAME SELECTION AND INPUT **"
DEFAULTNAME$=FILENAME2$
GOSUB 8100      :REM INPUT NAME/START NEW FILE
FILENAME2$=FILENAME$    :REM SET NEW OR SAME DATA FILE
REM
REM -- MAKE DIRECTORY NAME A SUBSET OF DATA FILE NAME --
GOSUB 7850      :REM SET FILENAME1$ AND ADD .DIR
GOSUB 7860      :REM PRINT CURRENT FILE NAMES
PRINT
REM
REM ----- OPEN DIRECTORY FILE AND WRITE HEADER -----
FILENMBR=1      :REM SET FILE NUMBER=1 FOR DIRECTORY
FILENAME$=FILENAME1$ :REM SET CURRENT FILE NAME
FILENAMEX$=FILENAME1$ :REM SET NAME WRITTEN ON FILE
IF END # FILENMBR THEN 9000
GOSUB 6000      :REM OPEN SEQUENTIAL DIRECTORY FILE
GOSUB 6100      :REM WRITE DIRECTORY HEADER RECORD
REM
REM ----- OPEN DATA FILE AND WRITE HEADER RECORD -----
FILENMBR=2      :REM SET FILE NUMBER=2 FOR DATA FILE
FILENAME$=FILENAME2$ :REM SET CURRENT FILE NAME
FILENAMEX$=FILENAME2$ :REM FILE NAME OF THIS DATA FILE
VERSIONX$=VERSION$ :REM PROGRAM VERSION WHEN CREATED
RNMBR=1         :REM RECORD NUMBER=1
RCNTX=1         :REM TOTAL # OF RECORDS IN FILE/LAST RECORD
GOSUB 6050      :REM OPEN RANDOM DATA FILE
GOSUB 6200      :REM WRITE RANDOM FILE HEADER RECORD
REM
NEXTRECORDX=0   :REM POINTER TO NEXT DATA RECORD
REM
PRINT"DATA FORM LOOKS LIKE:"
GOSUB 7870      :REM PRINT TITLE LINE FOR DATA RECORDS
REM
FOR NEWLOOP=1 TO 1 STEP 0
RNMBR=RNMBR+1   :REM RANDOM DATA RECORD NUMBER
RCNTX=RNMBR     :REM TOTAL RECORDS=CURRENT RECORD
TOTALCOST=0     :REM SET TOTAL COST FOR ITEM=0
PRINT
PRINT"ENTER FILING CATEGORY (NAME) OR 'DONE' ";
GOSUB 9202      :REM INPUT ALPHA,CHECK FOR QUIT
IF A$="DONE" THEN 1450
ITEMNAME$=A$    :REM SET ITEM NAME
GOSUB 7920      :REM INPUT DATE,DESCRIPTION,COST
IF A$="DONE" THEN 1450
TOTALCOST=TOTALCOST+COST        :REM CALCULATE TOTAL
REM
REM -SET VALUES WRITTEN ON DISK-
ITEMNAMEX$=ITEMNAME$
DATEX$=DATE$
DESCRIPTIONX$=DESCRIPTION$
COSTX=COST
TOTALCOSTX=TOTALCOST
FIRSTRECORDX=RCNTX :REM POINTER TO 1ST DATA RECORD
REM
REM -WRITE SEQUENTIAL DIRECTORY RECORD-
FILENMBR=1 :FILENAME$=FILENAME1$
GOSUB 6120      :REM WRITE NEXT DIRECTORY RECORD
REM
REM -WRITE RANDOM DATA RECORD-
RECNMBR=RCNTX   :REM RECORD NUMBER TO WRITE
TYPEX=TYPE2     :REM SET RECORD TYPE=DATA RECORD
FILENMBR=2 :FILENAME$=FILENAME2$
GOSUB 6220      :REM WRITE RANDOM DATA RECORD
REM
ADDCNT=ADDCNT+1 :REM INCREMENT RECORDS ADDED COUNTER
NEXT NEWLOOP
1450 REM        :REM ENTRY FROM ABOVE IF 'DONE' TYPED
REM ----- REWRITE RANDOM FILE HEADER RECORD -----
RNMBR=1         :REM CURRENT REC #=1 FOR RANDOM HEADER
RCNTX=RCNTX-1   :REM TOTAL RECORDS-1 FOR RANDOM HEADER
IF RCNTX <= 0 THEN RCNTX=1 :REM MINIMUM REC # IS 1
FILENAMEX$=FILENAME2$ :REM RESET FILE NAME IF CHANGED
GOSUB 6200      :REM REWRITE RANDOM FILE HEADER
PRINT
PRINT"FINISHED BUILDING NEW DATA BASE.."
PRINT"RECORDS ADDED=";ADDCNT
GOSUB 6095      :REM CLOSE ALL OPENED FILES
GOSUB 9220      :REM ENTER ANYTHING TO CONTINUE
RETURN
REM ..... END OF 'CREATE' (GOSUB 1400) .....
REM
1600 REM ---------------
REM      -     OPT     -
REM      ---------------
GOSUB 5000      :REM CLEAR SCREEN
PRINT"OPTIONS SELECTION.."
MENUFLAG=1
PRINT
PRINT"TEST FLAG (0 OR 1) ";
INPUT TEST
PRINT"PRINTER (0 OR 1) ";
INPUT PRINTER
PRINT
RETURN
REM
1700 REM ---------------
REM      -    CHANGE   -
REM      ---------------
REM CHANGE FILE NAMES FOR THIS RUN
GOSUB 5000      :REM CLEAR SCREEN
PRINT"CHANGE - ALLOWS CHANGING FILENAMES"
MENUFLAG=1      :REM SET FLAG SO DONT GET ILLEGAL
DEFAULTNAME$=FILENAME2$
GOSUB 7830      :REM PRINT CURRENT,INPUT NEW NAME
FILENAME2$=FILENAME$    :REM SET NEW DATA FILE NAME
GOSUB 7850      :REM SET FILENAME1$, ADD '.DIR'
PRINT
GOSUB 7860      :REM PRINT CURRENT FILE NAMES
GOSUB 9220      :REM ENTER ANYTHING TO CONTINUE
RETURN
REM
1800 REM ---------------
REM      -    DELETE   -
REM      ---------------
MENUFLAG=1
GOSUB 5000      :REM CLEAR SCREEN
PRINT"DELETE FROM FILE,"
PRINT
GOSUB 7860      :REM PRINT CURRENT FILE NAMES
PRINT
PRINT"ENTER CATEGORY OR NAME TO BE DELETED: ";
GOSUB 9202      :REM INPUT ALPHA, CHECK FOR QUIT
DELETENAME$=A$  :REM NAME TO BE DELETED FROM DIR.
DELETED=0       :REM FLAG=0 IF NOT FOUND
REM
PRINT"SEARCHING FOR '";DELETENAME$;"'"
REM OPEN DIRECTORY AND READ HEADER
IF END #1 THEN 9000
GOSUB 7050      :REM SETUP, OPEN FILE, READ DIR HEADER
REM
REM OPEN SCRATCH FILE AND WRITE HEADER
FILENMBR=2      :FILENAME$="SCRATCH1"
GOSUB 6000      :REM OPEN SEQUENTIAL SCRATCH FILE
GOSUB 6100      :REM WRITE SCRATCH SEQUENTIAL HEADER
REM
REM SEARCH AND COPY REST OF DIRECTORY TO SCRATCH
IF TEST=1 THEN PRINT"..SEARCH/COPY DIR TO SCRATCH"
IF END #1 THEN 1810
FOR DELETELOOP=1 TO 1 STEP 0
FILENMBR=1      :FILENAME$=FILENAME1$
IF TEST=1 THEN PRINT"..READING ";FILENMBR
GOSUB 6130      :REM READ DIRECTORY DATA RECORD
FILENMBR=2      :FILENAME$="SCRATCH1"
IF ITEMNAMEX$<>DELETENAME$ THEN GOSUB 6120
IF ITEMNAMEX$=DELETENAME$ THEN DELETED=DELETED+1
NEXT DELETELOOP
REM
1810 REM AT END OF DIRECTORY RECORDS,
```

Program Listing 1 continued

```
IF DELETED=0 THEN PRINT"CATEGORY NOT FOUND.." \
       :GOTO 1850
REM
REM COPY SCRATCH BACK TO DIRECTORY
PRINT"UPDATING DIRECTORY.."
GOSUB 6095      :REM CLOSE AND REWIND ALL FILES
FILENAME$=FILENAME1$
GOSUB 6000      :REM RE-OPEN DIRECTORY FILE
FILENAME$="SCRATCH1"
GOSUB 6000      :REM RE-OPEN SCRATCH FILE
REM
FILENMBR=2      :FILENAME$="SCRATCH1"
GOSUB 6110      :REM READ SCRATCH HEADER
FILENMBR=1      :FILENAME$=FILENAME1$
GOSUB 6100      :REM RE-WRITE DIRECTORY HEADER
REM
IF END #2 THEN 1830
FOR DELETELOOP2=1 TO 1 STEP 0
FILENMBR=2      :FILENAME$="SCRATCH1"
GOSUB 6130      :REM READ DIR DATA RECORDS ON SCRATCH
FILENMBR=1      :FILENAME$=FILENAME1$
GOSUB 6120      :REM WRITE DIR DATA RECORDS
NEXT DELETELOOP2
REM
1830 REM END OF COPYING SCRATCH TO DIRECTORY
PRINT"DIRECTORY UPDATED, ";DELETED;
PRINT"RECORD(S) DELETED FROM DIR."
REM
1850 REM ENTRY FROM NOT FOUND OR EXIT
GOSUB 6095      :REM CLOSE ALL OPENED FILES
PRINT
PRINT"DELETE FINISHED, ";
GOSUB 9220      :REM ENTER ANYTHING TO CONTINUE
GOTO 100        :REM MUST USE 'GOTO' NOT RETURN!!!
REM
REM
3000 REM
3010 REM ----- NOT HERE, RUN TAX2.BAS -----
REM EXITS PROGRAM BECAUSE FUNCTION IN ANOTHER PART
PRINT
PRINT"NOT HERE, TYPE 'RUN TAX2' FOR THAT FUNCTION"
GOTO 9991
REM
REM
5000 REM ----- CLEAR SCREEN AND RESET TO TOP -----
PRINT CHR$(CLEAR) :REM OUTPUT 'CLEAR SCREEN' CODE
REM SPEED UP VECTOR VIDEO DISPLAY...
FOR I = 1 TO 7 :PRINT CHR$(SPEED); :NEXT I
PRINT           :REM THIS PRINT FOR CRLF AFTER ABOVE
RETURN
REM
REM ----- BOILER PLATE PRINT LINES USED OFTEN -----
5010 PRINT"ENTER 999 OR Q TO QUIT OR STOP" :RETURN
5020 PRINT"ENTER ZERO (0) OR SPACE FOR NO CHANGE" :RETURN
5030 PRINT"CTRL-C TO EXIT THIS PROGRAM" :RETURN
REM
REM
REM ------------------------------------------
REM -     FILE PRIMITIVES, OPEN/CLOSE FILES    -
REM ------------------------------------------
REM
6000 REM ----- OPEN SEQUENTIAL FILE -----
OPENED=OPENED+1
FILE FILENAME$
RETURN
REM
6050 REM ----- OPEN RANDOM FILE -----
IF END # FILENMBR THEN 9000
OPENED=OPENED+1
FILE FILENAME$(BLENGTH)
RETURN
REM
6095 REM ----- CLOSE ALL OPENED FILES -----
IF OPENED <= 0 THEN RETURN
FOR I=1 TO OPENED :CLOSE (I) :NEXT I :OPENED=0
RETURN
REM
REM ------------------------------------------
REM -     FILE PRIMITIVES, SEQUENTIAL FILES      -
REM ------------------------------------------
REM LAST CHANGED: V1.5,14AUG78 - RNMBRX NOW = DUMX
REM
6100 REM ----- WRITE SEQUENTIAL HEADER RECORD (DIRECTORY) -
REM DO 'IF END ...' BEFORE ENTRY
WRITFLAG=1
IF TEST=1 THEN PRINT"* WRITING DIRECTORY HEADER RECORD..."
PRINT # FILENMBR;\
        DUMX,FILENAMEX$,DATE1X$,TITLE1X$,\
        DUM,DUM,DUM,\
        DUMMY$,DUMMY$,\
        DUMMY$
IF NOCLOSE=0 THEN CLOSE (FILENMBR)
WRITFLAG=0
RETURN
REM
6110 REM ----- READ SEQUENTIAL HEADER RECORD (DIRECTORY) --
REM DO 'IF END...' BEFORE ENTRY
READFLAG=1
IF TEST=1 THEN PRINT": READING DIRECTORY HEADER RECORD.."
READ # FILENMBR;\
        DUMX,FILENAMEX$,DATE1X$,TITLE1X$,\
        DUM,DUM,DUM,\
        DUMMY$,DUMMY$,\
        DUMMY$
IF NOCLOSE=0 THEN CLOSE (FILENMBR)
READFLAG=0
RETURN
REM
6120 REM ----- WRITE SEQUENTIAL (DIRECTORY) RECORD -----
REM DO 'IF END ...' BEFORE ENTRY
WRITFLAG=1
IF TEST=1 THEN PRINT"* WRITING DIRECTORY RECORD.."
PRINT # FILENMBR;\
        DUMX,DUM,DUM,DUM,\
        DATE2X$,ITEMNAMEX$,FIRSTRECORDX,\
        DUMMY$,DUMMY$,\
        DUMMY$
IF NOCLOSE=0 THEN CLOSE (FILENMBR)
WRITFLAG=0
RETURN
REM
6130 REM ----- READ SEQUENTIAL DIRECTORY RECORD -----
REM DO 'IF END..' BEFORE ENTRY
READFLAG=1
IF TEST=1 THEN PRINT": READING DIRECTORY DATA RECORD.."
READ # FILENMBR;\
        DUMX,DUM,DUM,DUM,\
        DATE2X$,ITEMNAMEX$,FIRSTRECORDX,\
        DUMMY$,DUMMY$,\
        DUMMY$
IF NOCLOSE=0 THEN CLOSE (FILENMBR)
READFLAG=0
RETURN
REM
REM ------------------------------------------
REM -    FILE PRIMITIVES, RANDOM ACCESS FILES    -
REM ------------------------------------------
REM 18AUG78,TAX V1.6,CHANGED DUM TO DFLAGX AT 6220,30
REM
6200 REM ----- WRITE RANDOM FILE HEADER RECORD -----
WRITFLAG=1
IF END # FILENMBR THEN 9000
IF TEST=1 THEN PRINT"* WRITING RANDOM FILE HEADER RECORD.."
PRINT # FILENMBR,1;\
        RNMBR,RSIZE,TYPE1,RCNTX,DUM,DUM,\
        FILENAMEX$,DATE1X$,VERSIONX$,\
        DUM,DUMMY$,\
        TITLE1X$,\
        DUMMY$,\
        DUMMY$
IF NOCLOSE=0 THEN CLOSE (FILENMBR)
WRITFLAG=0
RETURN
REM
6210 REM ----- READ RANDOM FILE HEADER RECORD -----
READFLAG=1
IF END # FILENMBR THEN 9000
READ # FILENMBR,1;\
        RNMBR,RSIZE,TYPE1,RCNTX,DUM,DUM,\
        FILENAMEX$,DATE1X$,VERSIONX$,\
        DUM,DUMMY$,\
        TITLE1X$,\
        DUMMY$,\
        DUMMY$
IF NOCLOSE=0 THEN CLOSE (FILENMBR)
READFLAG=0
RETURN
REM
6220 REM ----- WRITE RANDOM FILE DATA RECORD -----
WRITFLAG=1
IF END # FILENMBR THEN 9000
IF TEST=1 THEN PRINT"* WRITING DATA RECORD (RECNMBR)=";RECNMBR
PRINT # FILENMBR,RECNMBR;\
        RNMBR,RSIZE,TYPEX,DFLAGX,DUM,DUM,\
        ITEMNAMEX$,\
        NEXTRECORDX,\
        DATEX$,DESCRIPTIONX$,\
        COSTX,TOTALCOSTX,\
        DUM,DUM,\
        DUMMY$,DUMMY$,\
        DUMMY$
IF NOCLOSE=0 THEN CLOSE (FILENMBR)
WRITFLAG=0
RETURN
REM
6230 REM ----- READ RANDOM FILE DATA RECORD -----
READFLAG=1
IF END # FILENMBR THEN 9000
READ # FILENMBR,RECNMBR;\
        RNMBR,RSIZE,TYPEX,DFLAGX,DUM,DUM,\
        ITEMNAMEX$,\
        NEXTRECORDX,\
        DATEX$,DESCRIPTIONX$,\
        COSTX,TOTALCOSTX,\
        DUM,DUM,\
        DUMMY$,DUMMY$,\
        DUMMY$
IF NOCLOSE=0 THEN CLOSE (FILENMBR)
```

```
READFLAG=0
RETURN
REM
REM ..... END OF 'FILE PRIMITIVES' .....
REM
REM
7050 REM -- SETUP,OPEN FILE, READ DIRECTORY HEADER --
FILENMBR=1
FILENAME$=FILENAME1$
GOSUB 6000      :REM OPEN SEQUENTIAL DIRECTORY FILE
GOSUB 6110      :REM READ DIRECTORY HEADER
RETURN
REM
REM
REM
7800 REM -- PRINT CONTENTS OF SEQUENTIAL HEADER --
PRINT"-> DIRECTORY HEADER RECORD....."
PRINT"DIRECTORY FILE NAME=";FILENAMEX$
PRINT"FILE CREATION DATE=";DATE1X$
PRINT"DATA BASE TITLE=";TITLE1X$
PRINT
RETURN
REM
7805 REM -- PRINT CONTENTS OF SEQUENTIAL DATA RECORD --
PRINT"-> DIRECTORY DATA RECORD..."
PRINT"CATEGORY CREATION DATE=";DATE2X$
PRINT"FILING CATEGORY (ITEM NAME)=";ITEMNAMEX$
PRINT"FIRST DATA RECORD LOCATION= ";FIRSTRECORDX
PRINT
RETURN
REM
7810 REM -- PRINT CONTENTS OF RANDOM HEADER --
T=25            :REM SET TAB=COL 25
PRINT"--> RANDOM FILE HEADER RECORD..."
PRINT"CURRENT RECORD NUMBER:";TAB(T);RNMBR
PRINT"RECORD SIZE = ";TAB(T);RSIZE
PRINT"RECORD TYPE = ";TAB(T);TYPE1
PRINT"TOTAL RECORDS = ";TAB(T);RCNTX
PRINT"DATA FILE NAME = ";TAB(T);FILENAMEX$
PRINT"FILE CREATION DATE = ";TAB(T);DATE1X$
PRINT"PROGRAM VERSION WAS:";TAB(T);VERSIONX$
PRINT"TITLE OF DATA BASE = ";TAB(T);TITLE1X$
PRINT
RETURN
REM
7815 REM -- PRINT CONTENTS OF RANDOM DATA RECORD --
T=25            :REM SET TAB=COL 25
PRINT"RECORD NUMBER =";TAB(T);RNMBR
PRINT"RECORD SIZE =";TAB(T);RSIZE
PRINT"RECORD TYPE =";TAB(T);TYPEX
PRINT"CATEGORY (ITEM) NAME =";TAB(T);ITEMNAMEX$
PRINT"NEXT DATA RECORD IS:";TAB(T);NEXTRECORDX
PRINT"DATE OF ENTRY =";TAB(T);DATEX$
PRINT"DESCRIPTION =";TAB(T);DESCRIPTIONX$
PRINT"COST OF ITEM =";TAB(T);"$";COSTX
PRINT"CUMULATIVE COST =";TAB(T);"$";TOTALCOSTX
PRINT
RETURN
REM
7830 REM ----- REQUEST NEW FILE NAME (INPUT) -----
PRINT
PRINT"DEFAULT FILE NAME IS NOW: ";DEFAULTNAME$
PRINT"NEW FILE NAME (OR SPACE FOR NO CHANGE) ";
GOSUB 9202      :REM INPUT ALPHA,CHECK FOR QUIT
IF LEN(A$)<=1 THEN A$=DEFAULTNAME$
A$=LEFT$(A$,12) :REM SET MAX NAME LENGTH
FILENAME$=A$    :REM SET CURRENT FILE NAME
PRINT
PRINT"FILE NAME IS: ";FILENAME$
PRINT"IS THIS CORRECT (Y OR N)";
GOSUB 9202      :REM INPUT ALPHA, CHECK FOR QUIT
IF LEFT$(A$,1) <> "Y" THEN 7830
DEFAULTNAME$=FILENAME$  :REM RESET NEW DEFAULT NAME
NAMECHANGE=1            :REM 'NAME WAS CHANGED' FLAG
RETURN
REM
7850 REM ----- SET FILENAME1$ AND ADD '.DIR' -----
REM ENTER WITH 'FILENAME2$' SET TO NAME OF DATA FILE
REM RETURNS WITH 'FILENAME1$' SAME BUT WITH '.DIR'
LENGTH=8        :REM SET MAX LENGTH BEFORE "."
FOR J=1 TO 8
IF MID$(FILENAME2$,J,1)="." THEN LENGTH=J-1
NEXT J
FILENAME1$=LEFT$(FILENAME2$,LENGTH)+".DIR"
IF FILENAME1$=FILENAME2$ THEN PRINT"ERROR 7850.." \
        :PRINT"DATA FILE SAME NAME AS DIRECTORY" \
        :GOSUB 9220 \
        :GOTO 100
RETURN
REM
7860 REM ----- PRINT CURRENT FILE NAMES -----
PRINT"DATA FILE NAME IS........ ";FILENAME2$
PRINT"DIRECTORY FILE NAME IS... ";FILENAME1$
RETURN
REM
7870 REM ----- PRINT TITLE LINE FOR DATA RECORDS -----
PRINT
T2=10 :T3=46 :T4=56     :REM SET TABS FOR PRINT
PRINT"DATE";
PRINT TAB(T2);"DESCRIPTION";
PRINT TAB(T3);"AMOUNT";
PRINT TAB(T4);"TOTAL"
PRINT"-------";
PRINT TAB(T2);"----------------------";
PRINT TAB(T3);"------";
PRINT TAB(T4);"-----"
RETURN
REM
7920 REM ----- INPUT DATE,DESCRIPTION,COST -----
PRINT"DATE .........";
GOSUB 9202      :REM INPUT ALPHA,CHECK FOR QUIT
IF A$="DONE" THEN RETURN
DATE$=A$        :REM SET DATE OF ENTRY/START
PRINT"DESCRIPTION ...";
GOSUB 9202      :REM INPUT ALPHA,CHECK FOR QUIT
IF A$="DONE" THEN RETURN
DESCRIPTION$=LEFT$(A$,MAXDESCR) :REM TRUNCATE
PRINT"AMOUNT (COST)..";
GOSUB 9201      :REM INPUT NUMERIC,CHECK FOR QUIT
COST=A          :REM SET COST OF ITEM
RETURN
REM
8100 REM ----- START A NEW DATA FILE -----
PRINT
PRINT"NEW FILE CREATION."
PRINT"ENTER TODAYS DATE IN THE FORM:05AUG78  ";
GOSUB 9202      :REM INPUT ALPHA,CHECK FOR QUIT
DATE1X$=A$      :REM DATE OF FILE CREATION
DATE2X$=A$      :REM DATE OF ITEM CATEGORY CREATION
PRINT"ENTER TITLE OR DESCRIPTION OF FILE: ";
GOSUB 9202      :REM INPUT ALPHA,CHECK FOR QUIT
TITLE1X$=A$     :REM TITLE OF FILE SET (DIR AND DATA)
GOSUB 7830      :REM INPUT FILE NAME IF NEEDED
NEWFILE=1       :REM SET 'NEW FILE CREATION..' FLAG
PRINT
RETURN
REM
REM
REM ------------------------------------------
REM -          ERROR PROCESSING              -
REM ------------------------------------------
REM
9000 REM ----- GENERAL FILE HANDLING ERROR -----
PRINT
IF WRITFLAG=1 THEN PRINT"WRITE ";
IF READFLAG=1 THEN PRINT"READ ";
IF READFLAG+WRITFLAG=0 THEN PRINT"OPEN ";
PRINT"FILE ERROR..."
PRINT"FILE NUMBER (FILENMBR)=";FILENMBR
PRINT"CURRENT FILE (FILENAME$) IS: ";FILENAME$
PRINT"RECNMBR=";RECNMBR
PRINT"RNMBR=";RNMBR
PRINT"RCNTX=";RCNTX
IF READFLAG=1 THEN PRINT"CHECK DISK DIR TO SEE IF FILE EXISTS"
PRINT
GOSUB 6095      :REM CLOSE ANY OPENED FILES
GOSUB 9220      :REM ENTER ANYTHING TO CONTINUE
GOSUB 5000      :REM CLEAR SCREEN
GOTO 100        :REM RESUME AT MENU
REM
REM
9200 REM ----- CHECK FOR QUIT PROGRAM ENTRY  -----
IF A=999 THEN 9900
IF A$="Q" THEN 9900
IF A$="STOP" THEN 9900
RETURN
REM
9201 REM ----- INPUT NUMERIC AND CHECK FOR QUIT -----
INPUT A         :GOTO 9200
REM
9202 REM ----- INPUT ALPHA AND CHECK FOR QUIT -----
INPUT A$        :GOTO 9200
REM
9220 REM ----- WAIT FOR ENTRY TO CONTINUE -----
INPUT"ENTER ANYTHING TO CONTINUE: ";A$
GOSUB 9200 :REM CHECK FOR QUIT
RETURN
REM
9900 REM ----- QUIT PROGRAM ENTERED BY OPERATOR -----
PRINT
GOSUB 6095      :REM CLOSE ANY OPENED FILES
A=0             :REM RESET IF '999' WAS ENTERED
INPUT"QUIT OR RESTART (Q OR R) ";A$
IF LEFT$(A$,1)="R" THEN 100
REM
9990 REM ----- FINAL EXIT -----
PRINT
IF ADDFLAG=1 OR NEWFLAG=1 THEN PRINT ADDCNT;\
   " RECORDS ADDED TO FILE."
9991 REM ----- FINAL EXIT (PRIMITIVE) -----
PRINT"FREE BYTES AT END=";FRE
PRINT PROGNAME$;" ";
PRINT"VERSION ";VERSION$;
PRINT" FINISHED."
PRINT
END
```

SMALL BUSINESS COMPUTING

Programming Your Computer For A Tax Deduction

BY MARK E. BATTERSBY

The tax revolution has begun. Starting in California, the revolt is now reachng other states where people are voting to change their tax system. But why wait for the revolt to lower your taxes? With your personal computer, you can take advantage of existing tax laws to reduce your tax bill.

As strictly a hobby, your computer does little to produce significant tax savings. But convert it to a business — at least for tax purposes — and, suddenly, your tax bill begins shrinking.

Our federal income tax laws permit you to offset any income your hobby may earn with hobby expenses. Of course, in the unlikely event your hobby income exceeds the expenses of that activity, you must add the difference to your income from other sources. With a business, however, the amount of hobby expenses that exceeds hobby income may be used to offset or reduce income from other sources.

What is the big deal? Imagine an average taxpayer who normally finds himself paying about 32% of his income in taxes. If he purchases a book on programming costing $10, the entire amount comes from his pocket. However, as a business buying that same $10 manual, that individual spends only $6.80 of his own money and $3.20 of money he would normally pay in taxes. In essence, Uncle Sam picks up the tab for 32% of his purchases.

The best part about converting your computer or computer-related activities into your own business is that you don't actually have to realize a profit for the Internal Revenue Service to recognize you as a business. All that is required is a "profit motive". The desire or intention to eventually show a profit from your activity is sufficient to convert it from a hobby into a business.

Naturally, if your activity is showing a profit already it will make things simpler. By law, the IRS is required to accept as a business any venture that shows a profit in at least two out of five years. If the IRS doesn't believe it's really a business, the burden of proof is on their shoulders to prove that it is, in reality, a hobby.

Without profits in those two out of five years, you must prove that your involvement with computers is a business. And, to help you, Congress and the courts have created guidelines showing the areas that the Internal Revenue must consider before disallowing your business and all its related deductions.

To bring some degree of predictability into the area of hobby/businesses, Congress added a new provision to our tax law seveal years ago. The rules created a legal and binding presumption that an activity is engaged in for profit if certain requirements are met. The most publicized requirement was, obviously, the one permitting any taxpayer to postpone determination of whether his activity is a business or a hobby until he has engaged in the activity for at least five years.

To take advantage of this so-called "presumption," you must establish that the gross or total income from your activity exceeds the deductions attributable to that activity. If you can show a profit in at least two years during the period, the IRS, as noted, has the burden of proving that the activity was a hobby.

But remember; if your activity doesn't show any profits, this failure is not conclusive; you can still point to a number of other factors to show that your loss activity was really a business. The Internal Revenue Service does not have the responsibility of proving the activity was a hobby where you fail to show any profits.

To illustrate the guidelines established to ascertain the existence of a genuine profit motive, let's take a look at how you might conduct your computer-related activity. The manner in which you carry on those activities is very important. For example, maintaining complete books and records of the financial aspects of your computer operation is a point in your favor. More importantly, if you can demonstrate that you changed your method of operations in an attempt to realize a profit, you will make a strong case for your profit motive.

Another factor taken into consideration is your expertise in the field. Congress correctly reasoned that an individual with no flying exprience would be unlikely to successfully operate a business involving flying skills. Thus, an individual's expertise in the area of his endeavor will also be considered.

As a substitute for acknowledged or proven expertise, the lawmakers also took into consideration the widespread use of advisors. Thus, another indication of that all-important profit motive is the expertise of the taxpayer — or his advisors. According to the tax rules, a taxpayer's use of expert advice in carrying on an activity indicates a definite profit motive.

So far we have a computer owner

who has failed to show a profit from his activities. Under the tax rules, it is up to the individual to prove — if asked — that the activity is a business and not a hobby. Our activity would seem to be a business; after all, we conduct the operation in a business-like manner and with the intention of making a profit. We have the proper books and records and occasionally change our operating methods when our figures so indicate. And, because of our limited knowledge in certain areas, we regularly use the advice of our accountant as well as marketing specialists and others knowledgeable in our field.

Although this should be more than sufficient to prove to even the most skeptical IRS agent that we have a profit motive — if not the actual profits — there are still other indicators recognized by the tax authorities.

Time and effort devoted to the activity are also taken into consideration. In the eyes of our lawmakers, the devotion of time and effort to an activity indicates a profit motive. But, by the same token, if a taxpayer devotes little time to the activity, that fact alone will not necessarily be damaging. Once again, engaging qualified personnel to assist or advise would satisfy the time-and-effort requirement.

Equally important is the simple, but often overlooked, fact that there is more than one way to realize a profit. The expectation that the assets used in an activity may appreciate in value has been acknowledged by Congress. According to them, the term "profit" contemplates appreciation in the value of assets. Therefore, an overall profit may legally be achieved through a sale.

Imagine the possibilities. By gradually buying peripheral equipment or software, making your consulting or computer services more expensive to the client, you need not ever show a profit to be recognized as a tax business. All you need is proof that your computer equipment is increasing in value — difficult perhaps in this age of rapidly changing technology, but not when programs and related equipment are added into the computation.

When the ever-vigilant Internal Revenue Service looks at an activity, they also look at the principal investor. Thus, a taxpayer's success in other businesses can also be a factor. According to the tax rules, the success of a taxpayer in carrying on other activities can be used to show the present loss activity is being carried on for the ultimate expectation of turning a profit.

However, unlike the previous determining factors, the taxpayer must use the business acumen and energy displayed in other endeavors in the operation of his pleasure-related business, or his skills and energy in other areas may be used against him by the IRS.

Finally, we return to the area of profits or, more realistically, the losses of your computer-related activity. The venture's history of income or losses can be quite important. Although initial losses are to be expected in any business, subsequent losses should be attributable to some specific reversals which would show that the eventual goal of the activity is to show a profit. In the case of a home computer, general economic conditions, casualty losses or even excessive competition might serve as a satisfactory explanation of these later losses.

One court stated, "A business will not be turned into a hobby merely because the owner finds it pleasurable."

As already mentioned, a series of profitable years is the best evidence of a business activity. But where the profit is relatively small in relation to the investment, the IRS may feel that those small profits alone would not be a determinative factor.

Even the financial status of the individual taxpayer has a bearing on whether an activity will qualify as a business. For instance, if the activity has recreational benefits or the loss from the activity generates substantial tax benefits, a hobby is indicated. Fortunately for most of us, the courts have ruled that the recreational aspects of an activity do not, by themselves, convert the activity into a hobby.

In fact, one court went so far as to state: "A business will not be turned into a hobby merely because the owner finds it pleasurable; suffering has never been made a prerequisite to deductibility." Moreover, the individual's tax bracket should not be determinative if the owner has seen to it that the activity has been conducted energetically and in a business-like manner, the same court decided.

The presence or absence of any one of these factors is not controlling. That is, no one factor — not even the two profitable years out of five — can be used by the IRS to disallow your "business" deduction. In the same vein, the home computer owner cannot merely point to the fact that he kept records as the sole evidence that his activity was a business. All of the factors in each case must be considered and weighed. After all, these factors are only guidelines for, in the words of Congress, "ascertaining the existence of a genuine profit motive".

The question of whether your venture, project or activity will be treated as a business for federal tax purposes or whether it is merely an enjoyable hobby is a complex one. This brief look at our tax laws will better enable you to understand the moves you must make right now to insure qualification under as many of these tests as you possibly can.

For the many hobbyists and would-be businesses that have signed consent agreements with the IRS auditors and who are now approaching their time of judgement, these guidelines should be particularly helpful. Most consent agreements do not bind a taxpayer to show a profit in two out of five years. Instead, they only give the Internal Revenue Service the right to ignore the normal three-year statute of limitations and to go back to any of the five years should an audit reveal that your activity is not truly a business for tax purposes.

Whether your time of judgement under a consent agreement is approaching or whether you merely feel that your profit motive makes your venture a business and entitles you to all of the tax deductions of a business, now is the time to use these guidelines. □

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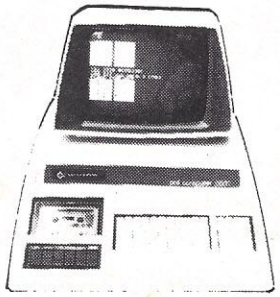

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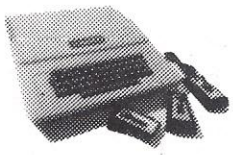

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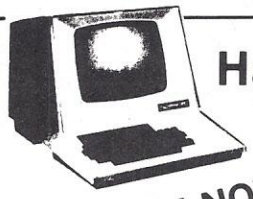

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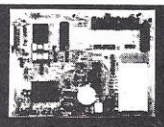

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CIRCLE 15

SMALL BUSINESS COMPUTING

The Incredible Time Machines

BY KIRTLAND H. OLSON

Ask a small business owner where he could use a computer and he'll probably answer "bookkeeping and payroll". Ask him whose effort contributes the crucial elements of the business and he'll answer "mine". For the business to grow, an entrepreneur must increase his own productivity, not only the bookkeeper's.

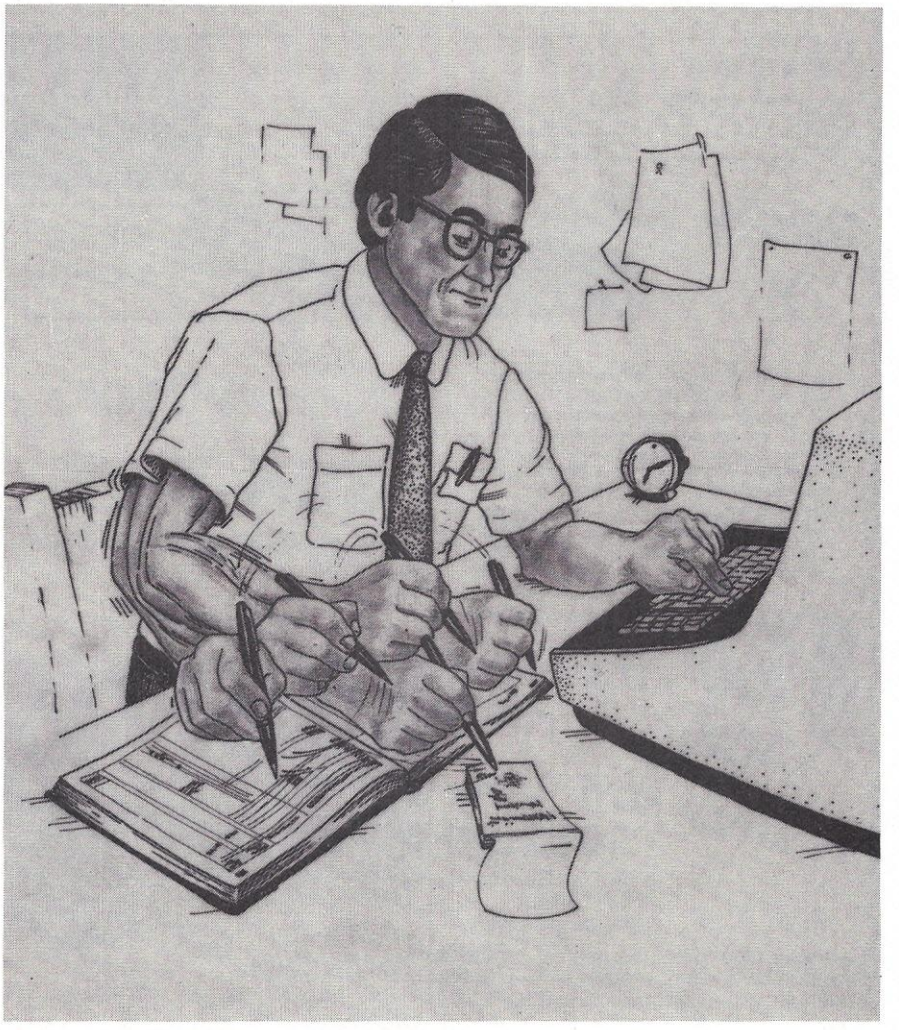
Microcomputers can increase your ability to do more in less time. You can get answers faster, gain more understanding of the business, play "what if" games, and free up your time to do what others (or machines) cannot.

Small businessmen usually perform multiple functions. Owners almost always provide some direct effort. In addition, the owner often provides indirect efforts, non-productive (but required) labor and business planning. Direct functions—selling, product testing, writing, illustrating or whatever—usually take precedence over everything else. Indirect efforts—scheduling, supervision, purchasing, design of a product or process and similar tasks—get high priority. Non-productive requirements come next—filling out government reports, time sheets, expense reports and other items on which the business cannot profit. Business planning gets what you can spare.

Saving your time in any one of these areas means you can grow personally and professionally. If you could do more in those hours for business planning, you effectively create more time. But you can also reduce the time required for direct, indirect and non-productive functions.

For example, suppose *you* provide all customer quotations. You always follow roughly the same procedure, perhaps you even have standard forms.

Management consultant Kirtland H. Olson heads The Harvard Group and teaches Technology Assessment at Boston University.



Still, these quotes commit your company, so you do them. Fine. Use the computer to do them faster and to contain such information as the date when you changed a part price.

All big businesses know that 20% of the jobs bring in 80% of the dollars. Your business will not be different, so don't try to cover every eventuality—take care of the 20%. Take the incomplete systems approach: get started now with the most useful pieces.

What about indirect functions? Well, take scheduling jobs in your shops. Scheduling depends on equipment, people, materials and customer needs. If one of your workers gets sick, you reschedule. If your best customer needs a favor, you reschedule. You won't do fewer reschedulings with a computer, but you can do them faster. When a job runs longer than you planned, you can see the impact on other tasks before you have idle employees and unhappy customers.

Well, surely a micro won't fill out government reports. No, but it will take dates, amounts spent, item purchased, and company or employee payment and turn out a reasonable table from which

to fill out those hated expense reports. Remember, the only way to make money on an expense account is to cut the cost of filling it out. You can even program the micro to compensate for the awful practice of imprinting your credit slip when you arrive at the hotel (thus making your receipt dates virtually useless).

Computers add speed and organization to business planning and always remember each detail you put into the program. Speed lets you try more ideas in your limited time. Organization provides more meaningful plans, free of conflicting assumptions and inconsistent results. Memory for detail keeps you from forgetting items in the third tentative plan when you put them in the first, second and fourth tries.

For example, if you sell plumbing fixtures to builders, you know how many houses each customer plans to construct. With very little effort you can find out how many houses, in total, were built in past years. Knowing your customers, you know how many plumbing fixtures (and how much pipe and tubing) go into each house. You can estimate the total requirements because you know which builders specialize in one-bath homes and which usually install two or three. Of course, every house is different, but, on average, they may require 2.1 bathrooms. Multiply that by 100 new homes and you forecast a market of 210 bathrooms. If your present customers build 50 houses, but use only 75 bathrooms you sell only 1.5 bathrooms per house. Your competitors sell 2.7 bathrooms per house.

Notice that each question you need to answer to analyze your business requires only a simple answer. By combining these simple answers you understand a complex problem. You do the analysis, the computer does the dog work. Also, once you solve the problem for one year, repetition for future years takes less time. Put in new data and you see the new answer.

"Will I need a professionally-written program to do these things?" you ask. No. When the user and the programmer are the same person, you can skip things like checking fields and handling incorrect responses. You'll want to add them later, but you want to get a working solution quickly. Add the error handling later and you can turn over the whole program to an employee who will then do just what you would. After all, the program does the work and you wrote the program.

Don't try to do everything at once. For example, if you operate a store, you inventory hundreds of items. But a small fraction need all the attention. Most items sell at close to the average rate. A few items keep giving you problems with stockouts and some seem nailed to the shelves. Solve those problems first.

Economic order quantity (EOQ) concepts can help you here, and virtually every micro can perform these computations. You need to know:

- Y, number of items used in one year
- S, costs and set-up charges of an order
- I, percent of your purchase cost associated with inventorying the product for one year
- C, purchase cost of one item

Use the following expression, or its equivalent, to calculate EOQ:

EOQ = (2 * Y * S / (I * C) ** 0.5

If the resulting order quantity falls near a price break, you adjust the numbers and recalculate to see if buying and storing, say, a full case really costs less than the charge for breaking a case.

Computers add speed and organization to business planning and always remember each detail you put into the program.

Now you know how many items to order at once and you need to figure out how many you need in minimum stock. You want the stock to last just until the new order comes in, but you don't want to run out. Safety stock supplies this demand, and you can find formulas to calculate how much you need.

"Wait!" you say, "This gets pretty complicated!"

Yes, but notice that you're looking for information on inventory control—your business—not computers. Computers help you to do things you understand, but you must provide the method. When you can't explain how to compute something related to your business, you need to learn more about your business. In simple languages, such as BASIC, you can write a program to do any process for which you can write directions in English.

To benefit from microcomputer assistance, keep these key ideas in mind.

- Keep your databases small, 100 items or so, to minimize problems of maintaining the data.
- Conserve the time of the thinkers
  - — reduce their doing time
  - — make their thinking time

more productive

- Solve repetitive problems to get multiple dividends of free time.
- Use partial solutions to speed up most of the job.
- Make the computer arrange the output for people to use.

Cutting materials—fabric, paper, wood, metal—plays a big role in many small businesses. In a cabinet shop, a bad choice of cutting plan can easily double the material cost for a job and leave much of the lumber in off-size pieces. Usually these pieces require another cutting before you can use them. Also, you bought all that sawdust at lumber prices.

Use the computer to try cutting plans quickly, like an electronic scratchpad. You can easily work with non-standard dimensions because the computer does the math. Losses for the saw kerf get counted up automatically.

If you try to make the computer devise a cutting plan, it may be more programming than you bargained for. Grain direction and pattern constraints add complexity. Instead, let the program evaluate your trial plan for losses, scrap and fit. For example, take the number of cuts times the kerf loss per cut and add all the piece dimensions, then compare that with the stock width. If losses plus pieces are greater than width, you make a new trial. You can easily achieve this level of programming and it will save time over the traditional paper and pencil routines.

Now you can use the time saved to improve the program—adding features that account for standard sizes, grain direction and bad spots in the material. One of the easiest additions is storing a small table of saw blade designations and kerf losses. Now instead of entering the kerf loss (a possibility for error) you can enter the blade designation and the computer automatically inserts appropriate kerf losses.

Subdividing a parcel of land presents similar problems of minimum piece size, losses to roadways and culverts. Additional constraints include well to septic tank seperation and setback re-

quirements for buildings. Ledge and swamp correspond to bad spots.

Job shops of every kind need scheduling for people, machines and materials. Often only the owner can answer when a customer asks "When will my car (or copies or TV or brochures) be ready?"

If you analyze your job shop, you will find a list of conditions to start any job. First, what does the job need? Second, do we have those things? If so, how long does the job take? If not, then when can we get everything together? When will we finish?

The questions amount to comparing requirements and stocks, one item at a time and getting a yes-no answer. Any negative answer generates a delay. After the longest delay, add the working time to get a time when you can deliver. Of course, you'll use some supplies on other jobs in the meantime. Why not make the computer work backwards from the delivery date, to the start time, add the lead time for obtaining supplies and print a list of what you need in inventory to meet future job commitments?

Of course, you'll still need to check vacation schedules and days off. If someone gets sick you'll need to reschedule jobs that depend on that person's talents. Gradually you will understand how to add these features to your program. Each step will provide immediate benefits and help you create the time to make improvements.

Reservation systems and appointment scheduling comprise similar problems. In restaurants, the headwaiter or hostess must keep each service person supplied with patrons at various stages of dining. Balancing the work-load keeps the service personnel working efficiently, maximizing sales and tips. In addition it distributes the task of clearing tables and avoids the messy appearance of an entire section where all diners left at once. Similarly, personal services, such as hairdressing, require customers in various stages of the process.

No matter what your business, you probably experience variations in the amounts you receive and pay out. Some expenses remain constant, others vary with the season. Income also changes, perhaps in a different pattern.

You can plan your needs for borrowing and foresee periods when you can make cash investments by building a simple financial model of your business. Simplify the problem by dealing only with major items and lumping the miscellaneous ones together. Separate fixed expenses and those that vary with the level of business. You can make such a program to do a month-by-month (or even weekly) forecast. You estimate each period's income and expenses, and generate a simple income statement.

As you know, your expenses increase as your sales go up. If your business needs an inventory of raw materials, your costs go up before you get increased sales, perhaps several months before. If you borrow to finance inventory, your cost of borrowing also rises before you gain new income.

With a model, you can examine these relationships for many different sales forecasts. You can find the sales volume that will require next month's income to buy inventory for next quarter's sales. If you never thought about it, you may find it hard to believe that sales growth can bankrupt you. Try a quick paper-and-pencil experiment with a business whose sales double every month and lag behind raw material purchases by three months. You will quickly see that such a business will require enormous cash investments for any reasonable ratio of sales price to raw material cost.

You can extend modelling far beyond the financial area of your business. In businesses with recyclable materials—metal casting or thermoplastic molding—the manufacturer melts two pounds of material for every pound shipped. Remelting the scrap, gates, runners and flash costs money, degrades the material and may lead to pollution problems. Using the computer to sum up the amount of remelting as reject rate and gate size vary will reveal the true cost of high scrap rates.

If you can write down simple, step-by-step relationships for a process, you can model it on a computer. Microcomputers can model very large systems since the model size depends on complexity rather than physical size. From the computer's viewpoint, a 100-million pound foundry requires no more capability than a million pound business—only bigger numbers.

Tax forecasting uses modelling principles and you can write the necessary program by following the instructions on the tax forms. Calculate all the sub-schedules first, then do the summary sheet. Once you have this model, you can forecast your taxes in minutes—the computer remembers the process and you supply data for each new situation.

Microcomputers can manipulate words and symbols as well as numbers. Consequently you can write a program to sort words or symbols into any order you wish. Even a primitive program that checks each symbol systematically against a table will sort far faster than a person.

Combined with a printer, a microcomputer provides considerably more power than many word processors because you can combine computing with manipulation. Consider what that means for letters that contain job cost estimates — you can do the estimate and type a personalized form letter on one machine. If you supply a relatively small number of items, you can even put the price book in the program; you enter quantities and part numbers and the microcomputer looks up the prices, extends the line items and calculates the totals.

Symbol manipulation also permits you to create graphic designs with calculated symmetry or asymmetry. Complex patterns can take hours to draw by hand — micros can display a new pattern in seconds. You change patterns at will, examining more results in an hour than you could draw in a day.

In situations where more trials improve your chances of success, microcomputers can increase your speed enormously. Even when the computer takes long times to complete its task, you get an opportunity to do something else while the computer works.

When you begin to program applications for your own use, you often run into numerical tables. Before you assume that you must store the entire table, look into the origins of those numbers. Many commonly used tables and numbering systems for components derive from formulas. Once too cumbersome for individual computation, these formulas offer substantial savings in memory usage. For example:

- Rule of 78s — Calculate this as a sum-of-the month's digits routine.
- Compound interest and related quantities — Look up the formulas in a textbook or handbook and program them directly.
- Wire tables — Multiply bare wire diameter by the 39th root of 92 to compute diameter of next lower AWG size.

• Preferred Values (Also called Renard series) — designated as R5, R10, R20, R40 or R80; in the Rj series the values are the jth root of 10 raised to the nth power, for N = 0 to j. Also, the step size approximately equals 100/j percent.

• Number sizes for screws — Divide the number size by 64 to obtain diameter in inches.

People with small businesses seem to be making a beginning in using these machines. Dick Miller, a partner in Miller Microcomputer Services and President of the TRS-80 Users Group of Eastern Massachusetts, said the group restricted membership to people who owned (or ordered) TRS-80 computers to keep the membership down to four dozen people. Since the beginning of 1978 the Millers built a profitable business renting microcompuers, selling game programs and giving application seminars.

You can already buy software for micros, but quality eludes many providers. Still, some software houses sell good, well-documented programs. Adam Osborne Associates offers software in book form — type it in yourself. Osborne claims that much available business software is primitive, bought cheaply from inexperienced programmers. Jill Miller agrees, saying "It's not professionally done." Dick adds, "Business programs need protection — proper handling of incorrect responses."

If you must deal with an amateur programmers, at least choose an experienced businessman — do it yourself. Start now. □

Return on Investment

Return on Investment (ROI) provides one measure of the desirability of a capital investment. From the investor's viewpoint, higher ROIs equate to more desirable projects. If your proposed project earns less than placing your money in a bank account (or a similar low risk investment) over the same period, you probably should not carry out the project. If you do decide to go ahead, recognize that your reason for doing so stems not from earning returns, but depends on some other criterion. Given several equally desirable investment alternatives, the one with the highest ROI becomes your economically rational choice.

Line 110 defines a function, used in printing, that you can use to translate input in millions of dollars to printout in thousands of dollars if you replace the one by one thousand. You could make any other translation between units similarly.

Note that all matrices use the default dimension of 10, so this program cannot handle more than 10 years without adding a dimension statement.

Line 150 requests the initial year, which you can usually put in as two digits, say 79, and similarly, line 160 requests the final year. You could input the intial year as 1 and the final year as 5 and use those labels instead of the date.

To calculate depreciation you need to assign an average life to the capital investment and line 170 requests this data. Now you must specify the earnings before interest and taxes, as well as the new capital, on a year by year basis.

Line 174 prints a header and then lines 175 through 179 request the corresponding input data. You enter earnings before interest and taxes, a comma and capital expenditures for each year.

The computational guts of this program reside between lines 190 and 600. Here all the computations that you would normally do by hand are performed automatically and properly summed to create the output data. The FOR-NEXT loop between lines 190 and 580 repeats the process for each year.

Line 200 reduces the earnings before interest and taxes by two factors to account for federal and state income taxes on earnings. (Presently this program does not provide for property taxes.)

Line 250 assigns a value of 7% to the investment credit, appropriate to assets with a life greater than 8 years. If you wanted to use a shorter life, you would alter the investment tax credit. This exemplifies a program needing intelligent use, because you could assign a value below 8 years to average life and the program wouldn't automatically adjust the investment tax credit. You could modify the program to do so. Line 300 calculates total earnings for the year as net earnings after taxes plus any investment tax credit. Line 325

ROIAD Program Listing

```
110 DEF FNA(X)=INT(1*X)
120 REM ROI CALCULATOR
125 REM DEFAULT DIM OF 10
150 ?"INITIAL YEAR";:INPUT IY
160 ?"FINAL YEAR";:INPUT FY
170 ?"AVERAGE LIFE";:INPUT L
174 ?"EBIT,NEW CAPITAL"
175 FOR Y=1 TO 1+FY-IY
176 INPUT EB(Y),CS(Y)
179 NEXT Y
190 FOR Y=1 TO 1+FY-IY
200 NE(Y)=EB(Y)*0.75*0.95
250 IC(Y)=CS(Y)*0.07
300 E(Y)=NE(Y)+IC(Y)
325 CE(Y)=E(Y)+CE(Y-1)
350 ND(Y)=CS(Y)*1/L
400 OD(Y)=OD(Y-1)+ND(Y-1)
450 NC(Y)=CS(Y)-0.5*ND(Y)
500 OC(Y)=OC(Y-1)+NC(Y-1)-OD(Y)
550 C(Y)=NC(Y)+OC(Y)
575 CC(Y)=C(Y)+CC(Y-1)
580 NEXT Y
600 RI=CE(1+FY-IY)/CC(1+FY-IY)
```

```
705 PRINT "ITEM";
710 FOR Y=1 TO 1+FY-IY
715 PRINT IY-1+Y,
720 NEXT Y
721 PRINT

725 PRINT "EBIT"
730 FOR Y=1 TO 1+FY-IY
735 PRINT  FNA(EB(Y)),
740 NEXT Y
741 PRINT

970 PRINT RI
```

**This sequence used to print each Row Header & variable; substitute for underlined portions. See Chart for details.*

cumulates the earnings from year to year.

Depreciation in this program was calculated separately for new and old investments. Line 350 calculates new depreciation on a straight line basis. Line 400 calculates the old depreciation, summing the old depreciation from last year plus the depreciation that was new in the previous year.

Line 450 calculates the net new capital and assumes that the asset is in use for half the year so that one half of the new depreciation reduces capital investment. Line 500 then calculates the old capital and line 550 then sums these two items to get the capital employed in a given year. Cumulative capital is the sum of the capital employed on a year by year basis.

Return on investment over the period equals cumulative earnings divided by cumulative capital, which provides a percent of the total investment returned on an average basis.

Beyond line 705, the function of the program is simply to print the data in a tabular form. Coding for this printing repeats with only the header and variable changing until we reach line 960. Line 970 prints the resulting return on investment.

Line Numbers for Print Sections of Program

VARIABLES		STATEMENTS				
XXXX	X(Y)	PRINT "XXXX";	FOR Y=1 TO 1+FY−IY	PRINT FNA(X(Y)),	NEXT Y	PRINT
ITEM	IY-1+Y	705	710	715*	720	721
EBIT	EB(Y)	725	730	735	740	741
NATE	NE(Y)	745	750	755	760	761
ITCR	IC(Y)	765	770	775	780	781
EARN	E(Y)	785	790	795	800	801
CUME	CE(Y)	805	810	815	820	821
NUCP	CS(Y)	825	830	835	840	841
NUDP	ND(Y)	845	850	855	860	861
OLDP	OD(Y)	865	870	875	880	901**
NNCP	NC(Y)	905	910	915	920	921
OLCP	OC(Y)	925	930	935	940	941
CUMC	CC(Y)	945	950	955	960	-

Notes: * Statement is actually PRINT IY−1+FY
** Error in line numbering — unforgivable in a professional program — does not affect the knowledgeable user/programmer.

ROIAD Variable List

IY	Initial year
FY	Final year
L	Average asset (for new investment)
EB(Y)	EBIT
CS(Y)	New capital
NE	Net earnings after state and federal income tax
IC	Investment credit
E	Earnings, including investment tax credit
CE	Cumulative earnings
ND	New depreciation
OD	Old depreciation (depreciation on new capital of prior years)
NC	Net (new) capital (reduced by tax credit & depreciation)
OC	Old capital (invested in earlier years) (reduced by depreciation)
C	Net capital invested (sum of old and new net capital)
CC	Cumulative capital
RI	ROI for period IY to FY

ROIAD Output Table Names

ITEM	Followed by years
EBIT	Earnings Before Interest and Taxes
NATE	Net After Tax Earnings
ITCR	Investment Tax Credit
EARN	Total Earnings for the Year
CUME	Cumulative Earnings
NUCP	New Capital
NUDP	New Depreciation
OLDP	Old Depreciation
NCCP	Net New Capital
OLCP	Old Capital
CUMC	Cumulative Capital

Discounted Cash Flow Rate of Return

This program finds the interest rate at which discounted values of a future stream of capital exactly equals the initial investment. That interest, or discount, rate is known as the discounted cash flow rate of return. It measures the profitability of an investment by accounting for both the money returned and the time at which the money becomes available.

Most of the listing is self-explanatory once you know the functions performed. Major functions include input, control, checking and computation.

All program lines below 100 serve to set variables or control dimensions.

Lines 100 and 105 request investment data, and line 110 automatically requests the first year cash flow. Now the program enters a wait loop comprising lines 120 and 130, and you use keyboard entries to control the next action. If you want another year of cash flow, push "+"; the program will display the next year number, request a cash flow value, and re-enter the wait loop at 120 and 130. Pushing any character on the keyboard other than "+" will initiate computation of the discount rate using the previously entered cash flows.

Line 155 checks to see that the sum of the undiscounted cash flows exceeds the investment. If the cash flows fail this test, the program prints "NEGATIVE RETURN — LIQUIDATING" and proceeds to last statement for another program run.

Normally, as soon as you strike a key to initiate computation, the program prints the message seen at the bottom of the sample run up to the word "equals". In a few moments, the computer completes the line and, since the program contains "RUN" as its last statement, the input loop begins again.

Lines 170 through 220 perform the actual calculation of the interest rate. Beginning with a discount rate of 100%, the program calculates the net present value of the cash flow for the assumed interest rate. If the net present value turns out to be positive, you must increase the interest rate, if negative, decrease it. This program, specifically line 210, adjusts the interest rate using a strategy known as binary search, in which the trial value is adjusted by one half of the previous increment. On the PET, the SGN function takes three values. When the argument of the SGN function equals zero, the function returns a zero rather than an arbitrary sign. Otherwise it returns a plus or minus one, corresponding to a positive or negative argument. Consequently, you can use the SGN function directly as a multiplier to set the sign of the interest rate adjustment.

The program ends after either 99 attempts to find the interest rate, or when the difference between two successive interest rates equals zero.

If you use a different computer, notice that lines 150 and 155 depend upon the multiple statement capability of the computer to effect correct program logic. If your machine does not permit multiple commands on one line, take care to construct the appropriate replacement sequence.

This program requires a knowledgeable user, not only because of the complexity of operating the program, but because it provides no error handling when you respond improperly to the input sequence. Furthermore, it prints interest rates in scientific notation when they fall too low, and under certain circumstances, the program will generate a negative discount rate. Knowledgeable users would recognize these occurences and act accordingly.

Program Listing

```
 10   DIM NV(100), I(100)
 85   I(1)=1
 90   K=1
 95   CS=0
100   PRINT "INVESTMENT";
105   INPUT IV
110   PRINT "YEAR";K;"CASH FLOW";
115   INPUT CF(K)
120   GET C$
130   IF C$=""THEN 120
140   CS=CS+CF(K)
150   IF C$="+" THEN K=K+1: GO TO 110
155   IF IV-CS>0 THEN PRINT "NEGATIVE
      RETURN--LIQUIDATING":GO TO 241
160   PRINT "THE";K;"-YEAR DISCOUNTED RATE OF
      RETURN FOR THIS PROJECT EQUALS";
170   FOR J=1 TO 99
175   SM=0
180   FOR L=1 TO K
190   SM=SM+CF(K)/(1+I(J))↑L
195   NEXT L
200   NV(J)=SM-IV
210   I(J+1)=I(J)+SGN(NV(J))*(1/2)*ABS(I(
      J)-I(J-1))
215   IF SGN(I(J)-I(J-1))=0 THEN GO TO 240
220   NEXT J
240   PRINT 100*I(J);"%"
241   RUN
```

Program Run

```
INVESTMENT?  10
YEAR 1     CASH FLOW?       -1
YEAR 2     CASH FLOW        0
YEAR 3     CASH FLOW        1
YEAR 4     CASH FLOW        2
YEAR 5     CASH FLOW        4
YEAR 6     CASH FLOW        8
YEAR 7     CASH FLOW        16
YEAR 8     CASH FLOW        30
YEAR 9     CASH FLOW        30
YEAR 10    CASH FLOW        30

THE 10-YEAR DISCOUNTED RATE OF RETURN
FOR THIS PROJECT EQUALS 36.1110704%
```

SMALL BUSINESS COMPUTING

How to Add Graphs to Your Computer Output

Graphs liven up business reports and presentations and school papers and projects. As visual aids, graphs let the reader grasp the meaning of statistics and figures in one glance. Even without a plotter, you can produce effective graphics by use of the TAB function in subroutines.

BY R. TICKELL

Graphics have a lot more visual appeal than tables of data or pages of text. Graphics' impact and emphasis lend character to a message.

There is admittedly greater precision possible in a table of data than in measurements made from a graph. And it's also possible to employ fairly simple mathematical methods for extrapolating and interpolating data in tables.

But for getting a point across quickly and effectively, graphics are hard to beat. The question is: "What if your data processing system is not (yet) equipped with a graphics facility?"

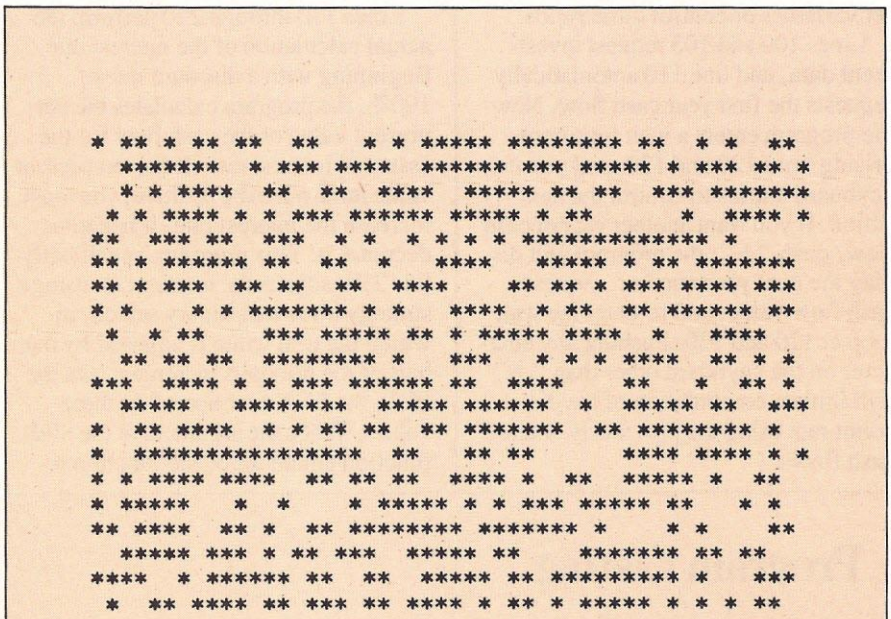
No problem! The TAB function in BASIC is capable of more than setting up tables and columns. It can be used to graph curves of functions, a variety of displays (such as scattergraphs) and even geometric figures. Of course, the method described here is pretty general and is equally applicable to other programming languages.

The difficulties involved in applying these techniques are not so much cerebral as they are tactile. Attention to detail is required in planning layouts and counting squares.

Here is a simple introductory example that demonstrates the principle of the TAB function (see Fig 1):

Problem: Run a quick check on the randomness of a number-generating mechanism.

Method: Generate a single row array of 50 columns. Generate 50 numbers in the range 1-50 using the number generating mechanism. For each of the 50 numbers generated, place an asterisk in the correspondingly numbered column of the array. Multiple occurrences of a given number are not counted — one asterisk per number generated is maximum. Print out the array. Clear the



Program Listing

```
00090 RANDOMIZE
00100 DIM A$(50)
00110 FOR J=1 TO 20
00115 REM *  *  *  *  *  *  *
00120 FOR K=1 TO 50 A$(K)=' '
00125 REM *  *  *  *  *  *  *
00130 FOR I=1 TO 50
00140 LET X=INT(RND*50+0.5)
00150 LET A$(X)='*'
00160 NEXT I
00165 REM *  *  *  *  *  *  *
00170 FOR L=1 TO 50 PRINT A$(L);
00180 PRINT
00190 NEXT J
00200 END
```

Figure 1

array. Repeat the process 20 times for comparison. The uniformity of the 50x20 pattern so generated is a measure of the randomness of the numbers generated.

Programming Notes on Figure 1: Line 120 clears the array before each new line of asterisks is generated.

Line 140 generates a random number in the range 1-50.

In line 170, the semi-colon on the end of the print statement inhibits a line feed until the loop has completed the printing of the full array of asterisks on one line. Then line 180 prompts a 'line feed'.

Line 130 shows the effect of letting the generator produce more than 50 numbers each time the same array is loaded. Try using 100, 150, 200, 250.

So much for a quick and simple exercise. Incidentally, the math student may frown on the adequacy of the above test of randomness. But the merit of the display of Figure 1 is the simplicity with which gross errors may be quickly and easily detected before embarking on a more exhaustive test.

Another program that generates large print numbers, characters or other geometric figures is demonstrated in Figure 2. The program is set up to read data pairs from a table; the first of each pair defines the number of blanks and the second defines the number of asterisks to be printed. Multiple groups of asterisks per line may be printed; a trailer signals the end of a line of print to initiate a line feed.

Programming Notes on Figure 2: The one-to-one relationship of data, statements in the program to lines of print in the figure is an aid to understanding and debugging; it is otherwise wasteful of program space.

Depending on the capabilities of the particular BASIC processor used, I/O files may be needed to store large amounts of data for larger displays.

The quantity B relates to blanks; S refers to stars or asterisks. Each time a string of either character is printed, the quantity is added to the TAB count (in lines 80 or 160) to update the print head position in readiness for the next print operation.

A common problem encountered in setting up this program is to accidentally omit a data quantity causing Bs to be read as Ss. The result of this misregistration is spectacular since all the 99 trailers are read as S quantities!

Now for the graphing of functions. First, see how easily the X and Y axes may be generated (Figure 3).

To plot the desired function in the display requires that a calculation be made as each *horizontal* line is printed, expressing the TAB quantity in terms of X units (in contrast to the conventional procedure of calculating the *vertical* or Y dimension). In other words, we set up a lot for x=f(y) instead of y=f(x).

The following example demonstrates a conversion between degrees F and degrees C over the range of freezing to boiling points of water (Figure 4).

Programming Notes of Figure 4: The vertical scale represents degrees C. Each of these values is used to calculate the corresponding value of degrees F on the horizontal scale. The equation used is F = (C x 5/9) + 32.

The scale of units employed in the plot is 4 degrees F per column and 5 degrees C per line. The addition of 5 units to each value calculated in line 170 displaces the plot 5 columns from the left-hand side of the page.

The line of dots generated at C = 100, 75, 50, etc., is controlled by a "remainder arithmetic" calculation: if the value of C divided by 25 is an integer value (no remainder) then control is passed to the "line of dots" subroutine.

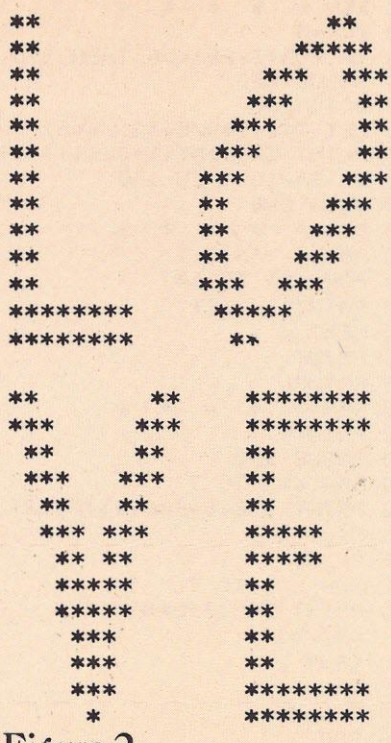


Figure 2

Program Listing

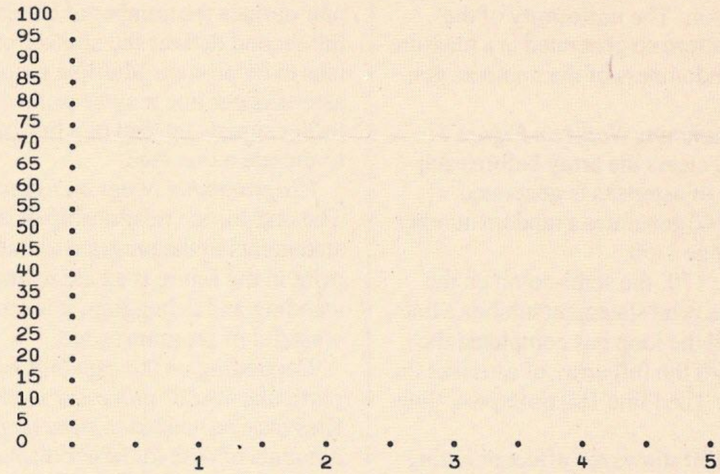
```
00010 T=0
00020 REM *  *  *  *  *
00030 READ B
00040 IF B<>99 THEN 70
00050 PRINT
00060 GOTO 10
00070 IF B=100 THEN 190
00080 T=T+B
00090 REM *  *  *  *  *
00100 READ S
00110 PRINT TAB(T);
00120 FOR C=1 TO S
00130 PRINT"*";
00140 NEXT C
00150 REM *  *  *  *  *
00160 T=T+S
00170 GOTO 30
00180 REM *  *  *  *  *
00190 DATA 5,2,18,2,99
00200 DATA 5,2,16,5,99
00210 DATA 5,2,14,3,2,3,99
00220 DATA 5,2,13,3,4,2,99
00230 DATA 5,2,12,3,5,2,99
00240 DATA 5,2,11,3,6,2,99
00250 DATA 5,2,10,3,6,3,99
00260 DATA 5,2,10,2,6,3,99
00270 DATA 5,2,10,2,5,3,99
00280 DATA 5,2,10,2,4,3,99
00290 DATA 5,2,10,3,2,3,99
00300 DATA 5,8,5,5,99
00310 DATA 5,8,6,2,99
00320 DATA 1,0,99
00330 DATA 4,2,7,2,4,8,99
00340 DATA 4,3,5,3,4,8,99
00350 DATA 5,2,5,2,5,2,99
00360 DATA 5,3,3,3,5,2,99
00370 DATA 6,2,3,2,6,2,99
00380 DATA 6,3,1,3,6,5,99
00390 DATA 7,2,1,2,7,5,99
00400 DATA 7,5,7,2,99
00410 DATA 7,5,7,2,99
00420 DATA 8,3,8,2,99
00430 DATA 8,3,8,2,99
00440 DATA 8,3,8,8,99
00450 DATA 9,1,9,8,99,100
00460 END
```

The MOD(I,25) function in line 140 is equivalent to the statement (I/25 — INT(I/25) * 25.

Line 180 is a rounding operation to give the correct integer value for a TAB function.

Lines 320 and 350 may be simplified arithmetically, but stating the TAB calculation explicitly is an aid to understanding its construction. For example, the −2 quantity centers the 3 digit F quantities their associated dots. The constant 5 added in line 320 staggers the first part of the F scale 4 columns away from the numerals in the second part which has a constant 1 added, (5−1=4).

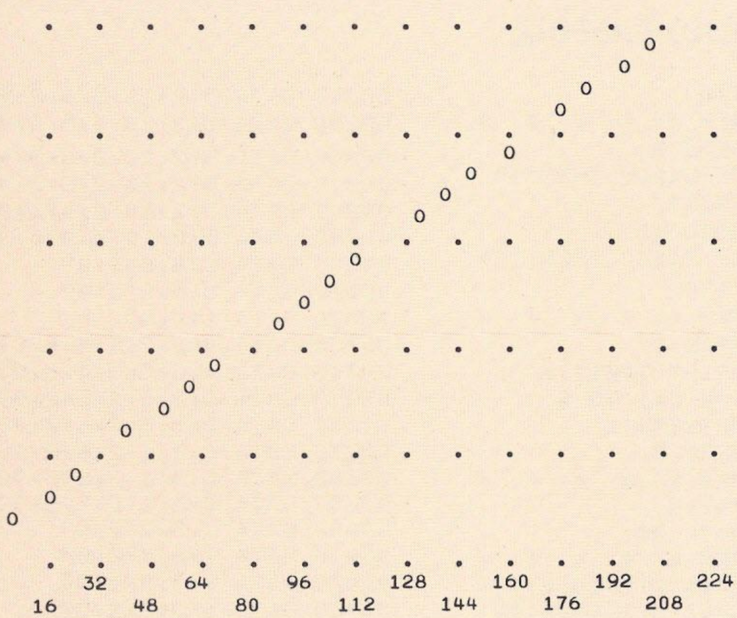
The presentation of graphs in the conventional manner with the independent variable (X-axis) plotted across the page is sometimes impractical to arrange. Perhaps the scale required is at odds with the geometry of the paper (width versus length). In this event it is better to plot the Y values across the page, leaving unlimited scope for the plotting of the X scale values vertically. The following example of a bouncing-ball kind of plot demonstrates this technique (Figure 5).



Program Listing

```
00100 FOR I=100 TO 5 STEP -5
00110 PRINT I;TAB(5);'.'
00120 NEXT I
00130 REM * * * * * *
00140 PRINT ' 0';TAB(5);'.';
00150 FOR J=1 TO 10
00160 PRINT TAB(5+J*5);'.';
00170 NEXT J
00180 PRINT
00190 REM * * * * * *
00200 FOR K=1 TO 5
00210 PRINT TAB(5+K*10-1);K;
00220 NEXT K
00230 PRINT
00240 END
```

Figure 3




```
00100 LINES 0,132
00110 I=105
00120 REM * * * * *
00130 I=I-5
00140 IF MOD(I,25)<>0 THEN 170
00150 GOSUB 220
00160 GOTO 130
00170 LET T=((I*9/5+32)/4+5)
00180 PRINT TAB(INT(T+0.5));'O'
00190 IF I>-15 THEN 130
00200 GOTO 290
00210 REM * * * * *
00220 PRINT TAB(6);
00230 FOR J=1 TO 14
00240 PRINT'    .';
00250 NEXT J
00260 PRINT
00270 RETURN
00280 REM * * * * *
00290 PRINT' '
00300 GOSUB 220
00310 FOR K=1 TO 7
00320 PRINT TAB(5+K*8-2);K*32;
00330 NEXT K
00335 PRINT
00340 FOR L=1 TO 7
00350 PRINT TAB(1+L*8-2);
      L*32-16;
00360 NEXT L
00365 PRINT
00370 PRINT' '
00380 END
```

Figure 4

Programming Notes on Figure 5: The function plotted is based on the product of a sinusoid and an exponential decay. The use of absolute value of the function in line 160 means that negative quantities are plotted as positive quantities — full wave rectification in electronics parlance.

The maximum value of the function as denfined is 1.0; the plot width is adjusted in the TAB calculation of line 140 to 50 columns width. The maximum value of the X scale is limited only by the length of paper in the printer.

The TAB function calculation should really be rounded to an integer value for better accuracy. The rounding has been omitted in this example for the sake of simplification.

The SIN function of line 150 works with an angle specified in radians; the constant 22/7 used is an approximation for pi. Pi radians is a measure equivalent to 180 degrees; and 4 times pi radians, used here, is equivalent to 4 x 180 degrees or two complete cycles of the SIN plot.

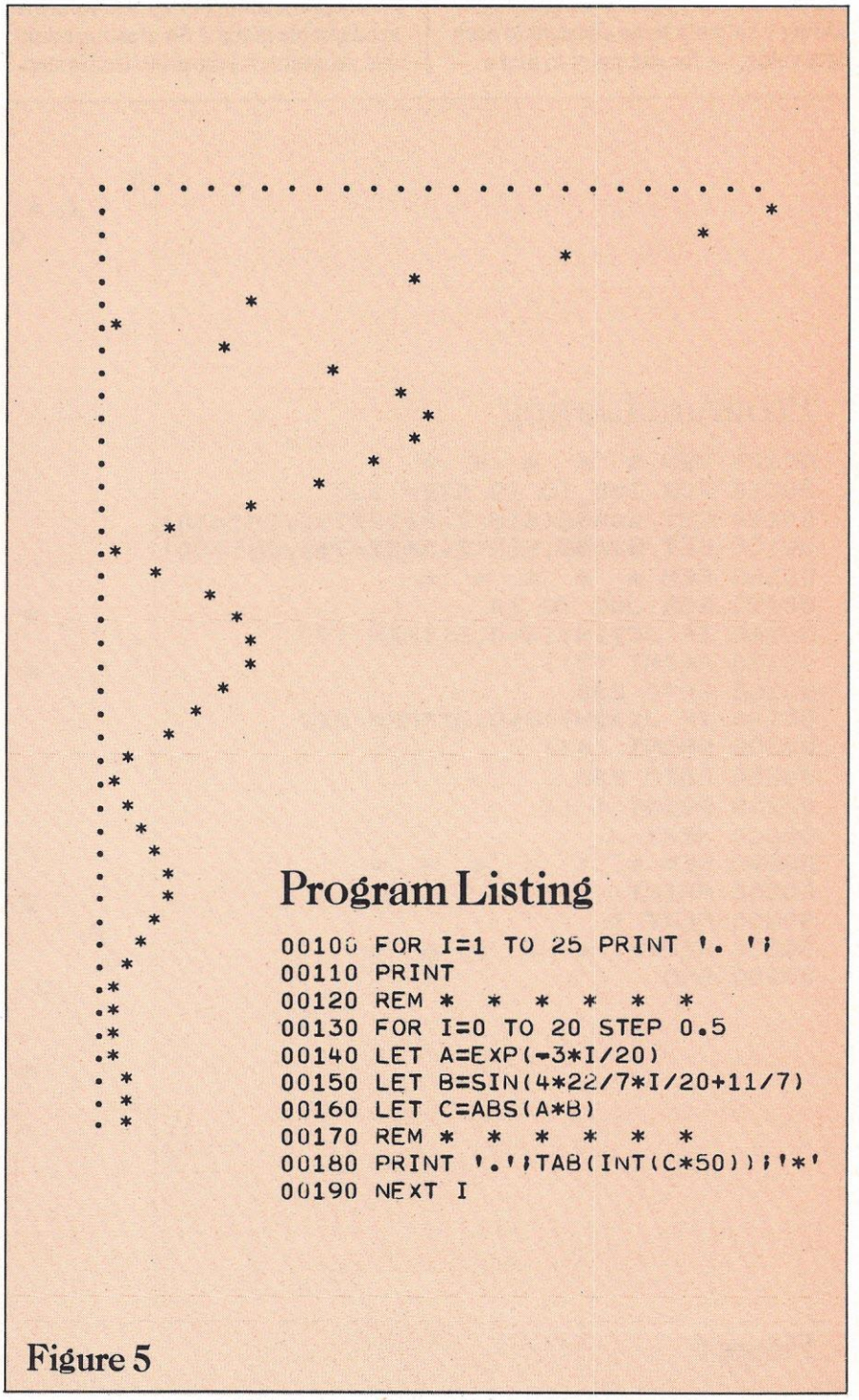
Finally, let's see how to combine several traces on one display without confusion. Graphs drawn by hand solve this problem with different colors or by using a different symbol for each trace. For example, one trace may be composed of dashes, another of asterisks or another of zeros. The second method is more suited to our printer displays.

There is a second problem to be solved: How can we handle the situation where curves cross each other and several symbols need to be superimposed at the point of intersection? The BASIC TAB function would concatenate these symbols instead of superimposing them and thus distort the plot. We must resort to a slightly more elaborate use of TAB.

Figure 6 demonstrates a trace of two sine waves (absolute value) of differing period. Each horizontal line is printed by a FOR loop in which each print position (column) is tested individually to see which character should be printed in each successive column — a zero, an asterisk or a blank. Each of the different function values is tested in a pre-established sequence. The first one to qualify with a data point printed at that point of the graph is the *one* value printed; the others are ignored as if they were concealed below the first plot at that point. If none of the functions being plotted has a data point to be printed in that column, then a blank is printed.

Note that the order of precedence in testing of function values determines which curve predominates in the composite plot. Therefore, prior consideration must be given to decide which trace should appear to be superimposed on the others. In the example of Figure 6, the curve of zeros predominates by appearing to be superimposed on the trace of asterisks.

Programming Notes on Figure 6: Be sure to round data values before plotting them. The TAB function responds only to the integer part of a decimal fraction and there will be small but detectable inaccuracies in the plots (espe-



Program Listing

```
00100 FOR I=1 TO 25 PRINT '. ';
00110 PRINT
00120 REM *  *  *  *  *  *
00130 FOR I=0 TO 20 STEP 0.5
00140 LET A=EXP(-3*I/20)
00150 LET B=SIN(4*22/7*I/20+11/7)
00160 LET C=ABS(A*B)
00170 REM *  *  *  *  *  *
00180 PRINT '.';TAB(INT(C*50));'*'
00190 NEXT I
```

Figure 5

cially with intersections of curves and lines) if the data is not rounded before plotting. As mentioned in the temperature conversion program above, the process of rounding involves adding 0.5 to the decimal fraction, then taking the integer part of the sum. (See lines 70 & 100.)

If both negative values and positive values are to be plotted, then we must convert all data to positive values by adding a suitably large constant to each data value, — for example, to plot a curve that may range from +100 to −25, add a value of 25 to each output value. This will allow the plot to be contained in a 125 column display. (Of course, the scale printed along with the curve should still show the proper range of values, +100 to −25.)

Not demonstrated but fairly easy to implement are histograms or bar charts. The column-by-column testing and printing procedure of Figure 6 would be an adaptable method for creating a suitable program. As the print head is stepped across the page, a series of asterisks is printed until the increasing column count exceeds the value that represents the function being plotted.

Other ways of generating graphics will depend on the particular functionality of the language processor used, but the TAB function is quite general and possibly universal. □

Note: The programming language used in the above examples is the Sperry Univac Series 1100 BASIC.

Program Listing

```
00100 REM *  *  *  *  *  *
00110 FOR I=0 TO 19 STEP 0.5
00120 LET A=ABS(SIN(1.5*22/7*I/20)*30)
00130 LET B=ABS(SIN(2.5*22/7*I/20)*30)
00140 REM *  *  *  *  *
00150 FOR J=0 TO 30
00160 IF J<>INT(A+0.5)THEN 190
00170 PRINT 'O';
00180 GOTO 230
00190 IF J<>INT(B+0.5)THEN 220
00200 PRINT '*';
00210 GOTO 230
00220 PRINT ' ';
00230 NEXT J
00240 REM *  *  *  *  *  *
00250 PRINT
00260 NEXT I
00270 REM *  *  *  *  *  *
00280 END
```

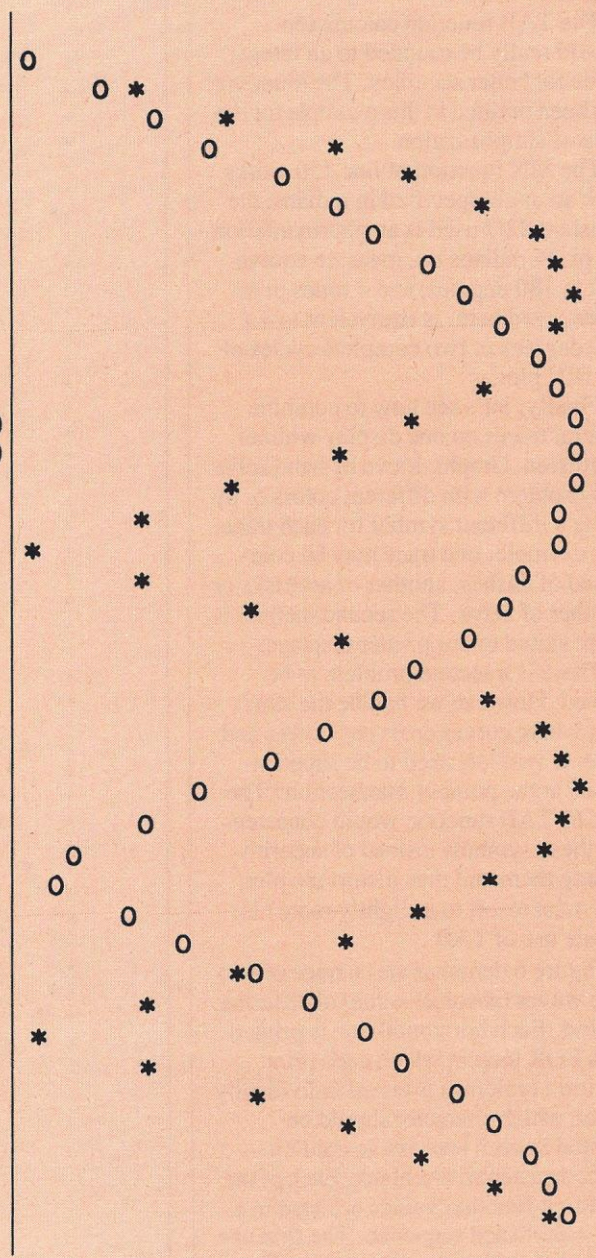


Figure 6

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A Simple Game Playing Field

BY L.D. STANDER

Complex games need large playing fields. But do large playing fields need lots of memory and bookkeeping? Nope. Here's a program you can slip into your favorite game to give you:

- A 100 x 100 position playing field without a DIM
- A four digit number for each position (0000 to 9999)
- The ability to write any four characters at any position
- The ability to display any 11 x 11 section of the field
- Five display options

The program is written in Extended Benton Harbor BASIC, version 10.01.01. The PRINT statements are formatted for use on a Heathkit H9 video terminal (12 lines x 80 characters).

The entire 100 x 100 array exists only in the mind of the programmer or player. Since few of the 10,000 positions are occupied, it's simpler and more economical to have the computer keep track of just the full positions.

By using a 100 x 100 array and numbering consecutively from 0000, left to right, top to bottom, you obtain a position number which tells you its vertical row with the first two digits and the horizontal column with the last two digits.

The 11 x 11 display format is due to the limitations of the H9 terminal. With twelve lines available, one line was left for some other use, such as a command input. If you use a different terminal, you can easily modify the display. Figure 1 shows the display options. The display builds itself around a focus point, which in most games would be the player's present location.

Refer to the program listing. Lines 100 through 180 are used to input enough inform: ı to demonstrate the routine. The value N serves as the display focus point. The value V determines which display option to use.

Lines 1000 through 1180 make up the display routine. Line 1010 separates N into its horizontal and vertical components. Depending on which display option is chosen, line 1020 directs the program to one of lines 1030 through 1070 where the display limits are set up. The program moves to lines 1080 through 1110 where the limits are kept within the array boundaries. Line 1120 sets up a loop within a loop to generate the position numbers within the display limits. Line 1130 diverts the program to the display ID routine where the position number is checked for occupancy. If not occupied the program returns to line 1140 where the numerical quantity N is converted to the string A$, to generate lead zeros where needed. A$ is printed by line 1150 and an end-of-row check is made by line 1160. The two loops are updated by line 1170. When the loops are completed, control returns to the main program in line 1180.

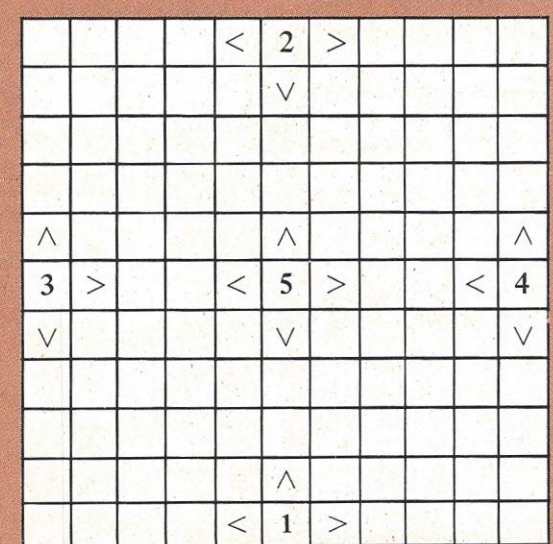
Lines 2000 through 2090 comprise the display ID routine. The program drops from line 1130 to lines 2000 through 2040. If the generated position number matches any of the noted positions the program moves to one of lines 2060 through 2090 to print a four character and one space message. If the position number doesn't find a match, the program returns to line 1140.

The three sample runs show you how the display should look. Sample Run 1 focuses the display at the center and extends five divisions in all four directions. Sample Run 2 focuses the display at the bottom-center and extends five divisions to the sides and ten divisions to the top. Sample Run 3 is directed to focus the display at the center, but because of array boundary limitations can only display a portion of the full display.

To enter this routine into your game, eliminate lines 100 through 180 and interface to the display ID routine. You'll need to modify the ID routine to meet your requirements. If your game needs a large number of occupied positions and time is important, you may want to add a sorting routine so that the generated position number is not tested against position numbers outside of the display limits. The ID print statements can be changed to print any four characters and a space or a string variable.

With all positions numbered with x-y coordinates, calculating movements, speeds, ranges and so forth is as easy as looking up basic equations in your old math book. □

Figure 1–Display Options



Program Listing

```
100 REM *** L.D.STANDER, ST. GEORGE, UTAH ***
110 REM *** 5/30/78 ***
120 INPUT "CENTER OF DISPLAY? ";N
130 INPUT "DIRECTION OF DISPLAY? ";V
140 INPUT "LOCATION OF POINT 1? ";P1
150 INPUT "LOCATION OF POINT 2? ";P2
160 INPUT "LOCATION OF POINT 3? ";P3
170 GOSUB 1000
180 GOTO 120
1000 REM *** DISPLAY ROUTINE ***
1010 Y=INT(N/100): X=N-(Y*100)
1020 ON V GOTO 1030, 1040, 1050, 1060, 1070
1030 X1=X+5: X2=X-5: Y1=Y: Y2=Y-10: GOTO 1080
1040 X1=X+5: X2=X-5: Y1=Y+10: Y2=Y: GOTO 1080
1050 X1=X+10: X2=X: Y1=Y+5: Y2=Y-5: GOTO 1080
1060 X1=X: X2=X-10: Y1=Y+5: Y2=Y-5: GOTO 1080
1070 X1=X+5: X2=X-5: Y1=Y+5: Y2=Y-5
1080 IF X1 >99 THEN X1=99
1090 IF X2 <0 THEN X2=0
1100 IF Y1 >99 THEN Y1=99
1110 IF Y2 <0 THEN Y2=0
1120 FOR H=Y2 TO Y1: FOR I=X2 TO X1: N1=(H*100)+I
1130 GOTO 2000
1140 A=N1+100000: A$=STR$(A): A$=RIGHT$(A$,5)
1150 PRINT A$;
1160 IF I=X1 THEN PRINT
1170 NEXT I: NEXT H
1180 RETURN
2000 REM *** DISPLAY ID ***
2010 IF N1=N GOTO 2060
2020 IF N1=P1 GOTO 2070
2030 IF N1=P2 GOTO 2080
2040 IF N1=P3 GOTO 2090
2050 GOTO 1140
2060 PRINT "CNTR ";: GOTO 1160
2070 PRINT "PNT1 ";: GOTO 1160
2080 PRINT "PNT2 ";: GOTO 1160
2090 PRINT "PNT3 ";: GOTO 1160
```

Sample Runs

```
*RUN
CENTER OF DISPLAY? 9494
DIRECTION OF DISPLAY? 5
LOCATION OF POINT 1? 9595
LOCATION OF POINT 2? 9696
LOCATION OF POINT 3? 9797
8989 8990 8991 8992 8993 8994 8995 8996 8997 8998 8999
9089 9090 9091 9092 9093 9094 9095 9096 9097 9098 9099
9189 9190 9191 9192 9193 9194 9195 9196 9197 9198 9199
9289 9290 9291 9292 9293 9294 9295 9296 9297 9298 9299
9389 9390 9391 9392 9393 9394 9395 9396 9397 9398 9399
9489 9490 9491 9492 9493 CNTR 9495 9496 9497 9498 9499
9589 9590 9591 9592 9593 9594 PNT1 9596 9597 9598 9599
9689 9690 9691 9692 9693 9694 9695 PNT2 9697 9698 9699
9789 9790 9791 9792 9793 9794 9795 9796 PNT3 9798 9799
9889 9890 9891 9892 9893 9894 9895 9896 9897 9898 9899
9989 9990 9991 9992 9993 9994 9995 9996 9997 9998 9999
```

Sample Run 1

```
*RUN
CENTER OF DISPLAY? 9494
DIRECTION OF DISPLAY? 1
LOCATION OF POINT 1? 9394
LOCATION OF POINT 2? 9294
LOCATION OF POINT 3? 9194
8489 8490 8491 8492 8493 8494 8495 8496 8497 8498 8499
8589 8590 8591 8592 8593 8594 8595 8596 8597 8598 8599
8689 8690 8691 8692 8693 8694 8695 8696 8697 8698 8699
8789 8790 8791 8792 8793 8794 8795 8796 8797 8798 8799
8889 8890 8891 8892 8893 8894 8895 8896 8897 8898 8899
8989 8990 8991 8992 8993 8994 8995 8996 8997 8998 8999
9089 9090 9091 9092 9093 9094 9095 9096 9097 9098 9099
9189 9190 9191 9192 9193 PNT3 9195 9196 9197 9198 9199
9289 9290 9291 9292 9293 PNT2 9295 9296 9297 9298 9299
9389 9390 9391 9392 9393 PNT1 9395 9396 9397 9398 9399
9489 9490 9491 9492 9493 CNTR 9495 9496 9497 9498 9499
```

Sample Run 2

This simple subroutine gives you a galaxy of game playing options.

```
*RUN
CENTER OF DISPLAY? 0000
DIRECTION OF DISPLAY? 5
LOCATION OF POINT 1? 0101
LOCATION OF POINT 2? 0202
LOCATION OF POINT 3? 0303
CNTR 0001 0002 0003 0004 0005
0100 PNT1 0102 0103 0104 0105
0200 0201 PNT2 0203 0204 0205
0300 0301 0302 PNT3 0304 0305
0400 0401 0402 0403 0404 0405
0500 0501 0502 0503 0504 0505
```

Sample Run 3

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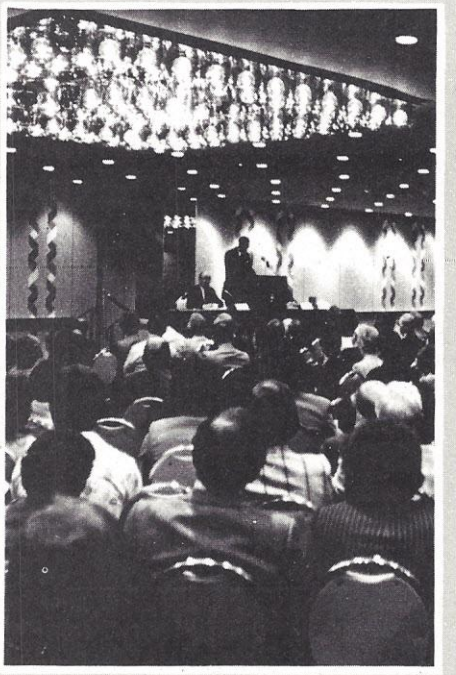
SYSTEMS, SERVICES AND EQUIPMENT



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Computer Programs for Bridge Bidding

BY THOMAS A. THROOP

My special interest in development of computer-bridge playing programs evolves from three principal stimulants. First of all, bridge, like chess, provides an excellent opportunity to devise, analyze and apply artificial intelligence techniques to a computer program in a game environment. The performance of a computer bridge playing program may be analyzed by bridge experts as to its level of performance, just as is done with computer-chess programs.

Secondly, being both a tournament-chess and tournament-bridge player, I realize that there are interesting differences in the thinking or intelligence required to play a high level game, and a good bridge playing program must be based on techniques different than a good chess playing program. Thirdly, a great deal of effort has led to numerous computer chess playing programs; however, there has been much less activity in development of computer bridge playing programs.

I have previously discussed some early efforts in development of computer programs for the "play" of cards as distinguished from "bidding." In particular, I briefly described a computer program whose heuristic playing algorithms I, myself, developed. These algorithms have been patterned after the logic a first class bridge player will consider during the play of a hand.

Bridge bidding differs greatly from the actual play of the cards. Bidding is an exchange of information between the two members of a partnership as they attempt to describe their holdings and arrive at the best contract. Correct procedures for playing certain card combinations, both as declarer and defenders, have already been well established, but there is a multitude of different bidding systems currently in use and no single particular system has ever been proven to be superior to others.

Debates about the virtues of various bidding systems creates loud cacophonies in card halls all over the world. There are bidding systems employed by numerous American tournament players. Different systems are used by Italians, French, and British. The Italians, who use extremely artificial bidding systems, have dominated world championship play for the past twenty years — including ten consecutive wins.

Are the Italians better card players? Or are their bidding systems superior to others and does that give an edge in world championship play? It would be interesting (but obviously a gigantic task) to codify every major bidding system and then provide computer "battles" between the various systems.

With the use of a computer we could theoretically increase the playing skills of our American bridge teams. Suppose that a first rate playing program were to be used for the play of the cards. Suppose, also, that a computer is programmed to bid the North-South hands according to a second system. Within the space of a few hours, several thousand hands can be dealt and played by the computer and the results scored. The same hands are then regenerated and played again; this time with North-South holding the previous East-West cards. For each "pair" the total score of the second set of results is added to the first total score. The system used by the pair emerging with the net positive score would than be judged to be the superior bidding system. In effect, such a scheme would constitute a team-of-four match between two teams of precisely equal playing ability, but employing two different bidding systems.

The scheme described above would make it theoretically possible to conduct computer battles between various American, Italian, French, and British bidding systems. Competing in future international tournaments our top-ranking teams would then be in a position to employ whichever bidding system had been judged (by the computer's results) to be superior. Perhaps our teams might then compile a better record in international competition.

In 1962 I wrote a bridge bidding program which was, at that time, the first program to involve any aspect of bridge. The program was operational on a UNIVAC 1 computer. Several factors were considered by the program, including high card points, additional distributional points, vulnerability, and preceding bids by other hands in deciding on each bid. The program was aware of many modern-day tournament conventions such as five card majors in first or second position, weak jump overcalls, and the Stayman and Gerber conventions. Following are a few hands which were dealt and bid entirely by the UNIVAC. The computer decides the bidding for each holding without being influenced by the cards known to be in the other hands.

HAND #1

North

♠ K8743
♥ ----
♦ AQ9863
♣ Q8

West	East
♠ A6	♠ QJ2
♥ Q3	♥ 10765
♦ 10742	♦ J5
♣ AK1075	♣ J432

South

♠ 1095
♥ AKJ9842
♦ K
♣ 96

Dealer: South
The bidding:

South	West	North	East
1C	Pass	2NT	Pass
3NT	Pass	Pass	Pass

South is dealer with neither side vulnerable. As South the computer opens one club with its thirteen-point hand rather than one spade or one heart. (It does not open a major suit in first or second position without five cards in the suit.) As West, the computer passes. With the North hand, the computer bids two no-trump, having thirteen high card points with balanced distribution. As East, the computer passes. On the second round of bidding the

computer, as South, bids three no-trump which is the correct final contract.

HAND #2

North

♠ A4
♥ K65
♦ J1054
♣ AJ53

West	East
♠ 1065	♠ J873
♥ A982	♥ 73
♦ K82	♦ Q763
♣ K96	♣ Q72

South

♠ KQ92
♥ QJ104
♦ A9
♣ 1084

Dealer: South
The bidding:

South	West	North	East
4H	Pass	Pass	Pass

South is dealer with East-West vulnerable. As South, the computer correctly preempts four hearts, having only five or six losers and non-vulnerable against vulnerable opponents. This is the final contract as the computer passes with each of the other hands.

The most difficult algorithms for a bridge bidding program are those concerned with competitive bidding situations. Here, not only may some bidding "space" be taken up by an inconvenient enemy bid, but also the best bid may depend on what type of environment is assumed. A rubber bridge game, a pair tournament event with match point scoring, a board-a-match team-of-four event, and a Swiss team-of-four event have significant scoring differences which especially affect competitive bidding strategy. I have devised, but have not encoded in a current program, some general purpose algorithms for handling high level competitive situations.

In the early 1960's a language was developed at the Air Force Cambridge Research Laboratories (AFCRL) in Bedford Massachusetts, to determine how special languages might facilitate the handling of very complex logical processes by a computer. Contract bridge bidding was chosen as the vehicle for this research. The bidding system selected to implement was the Roman Club, one of the Italian systems. This project produced some interesting results, but the bidding system was never completely implemented as a few of the key people left AFCRL in the middle of the project.

More recently, Alan M. Stanier, at the University of Essex in England, developed some algorithms for both bidding and playing of a bridge hand. Below is an example of a bidding sequence produced by his program.

The computer as South holds:

♠ J3
♥ AJ92
♦ Q98
♣ KQ43

West	North	East	South
Pass	1D	Pass	1H
Pass	1S	Pass	3NT
Pass	Pass	Pass	Pass

The computer's (South's) first bid of one heart shows at least four hearts. The rebid of three no-trump shows 12-15 high card points which gives enough points for game opposite North's opener, with three no-trump likely the best game contract.

Another program with bidding algorithms was written by Douglas H. Hoffman and Alan R. Schwartz at the University of California at Santa Barbara. The program was written in PL/1 and ran on an IBM 360/75. A hand illustrating the program's bidding is shown below:

North

♠ K965
♥ K7
♦ Q8732
♣ 86

East	West
♠ AJ83	♠ 7
♥ AQ1095	♥ J8432
♦ 64	♦ AJ9
♣ J2	♣ K1043

South

♠ Q1042
♥ 6
♦ K105
♣ AQ975

Dealer: North
The bidding:

North	East	South	West
Pass	1H	2C	3H
4D	4H	Pass	Pass

East opens one heart, bidding his longest suit. South overcalls two clubs. West gives a jump raise to three hearts. Some styles of bidding would call for a four heart bid by West, others for a three heart bid. North makes a questionable bid of four diamonds. East properly continues to game in hearts after hearing West's jump raise.

Again, I do not know what level of performance was finally reached by the Hoffman-Schwartz program. In a future column I shall report on this and on any new efforts on the part of Stainer or Hoffman-Schwartz.

In an upcoming column I will be describing some commercial bridge products coming on the market. These include a bridge playing program written by George Duisman and two new items (both, battery-operated dedicated-microcomputers) from Fidelity Electronics, Chicago, which were displayed for the first time at the January Consumer Electronics Show in Las Vegas. One product is called "Bridge Challenger" and it plays two hands against two opposing hands either as declarer or defender. The companion product, sold separately, is called "Bridge Bidder." As the name implies, it will generate proper bidding sequences for any two hands and will, in addition, display LED comments on the reason for the bid. The bidding machine, says Fidelity, will serve as a useful tool in learning how to bid; just as the Bridge Challenger will serve as a useful tool in learning how to play properly. Both products should be available in retail outlets around July. More on this later. Also, I shall comment on and/or include ideas received from Personal Computing readers.

I would like to hear from anyone who has an existing operational computer program for bidding, playing as declarer, and/or playing as defender. Perhaps a competition among the various programs might be arranged at one of the computer shows.

Any comments at all on computer bridge are welcome. Address your notes to Computer Bridge, Personal Computing, *1050 Commonwealth Ave., Boston, MA 02215.*

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Firmware Facts

Connecting the Disk

Part II: "Interfacing"

BY RODNAY ZAKS, SYBEX, Inc.

In the previous article, fundamental concepts of disk operation were reviewed. Here, the disk will be interfaced to a microcomputer system via a controller board. Signals available on the disk drive will be explained, then functions required from the controller board will be listed. Finally, new components will be described which facilitate the design of such interfaces.

Disk Drive Signals

Every disk drive is equipped with two sets of signals. One set represents the commands coming from the controller board which positions the head over the correct track. The second set of signals, coming from the disk drive, are status indicators informing the controller board of the position of the head as well as the status of its mechanical components. Finally, there is a line for reading data and one for writing data.

1 – Typical signals **to** the disk drive include:

- **Motor on**: Unlike hard disks, most floppy disks stop rotating when they are not used. They must, therefore, be turned on prior to use.
- **Direction Select**: This signal tells the read/write head to move inwards or outwards on the radius of the disk.
- **Step**: Whenever a stepping motor is used, this order will move the position of the head one step inwards or outwards. One to three steps may be needed to correctly position the head over the next track.
- **Read/Write**: This line indicates the operation to be performed.

2 – Usual signals coming **from** the drive:

- **Track 00**: This signal indicates that the head has reached the outermost track of the disk. When a positioning error of the head occurs, the head is moved back to track 00, and the correct number of pulses is applied to reposition the head over the desired track.
- **Index/Sector**: This status signal is generated whenever a hole is sensed in the disk. In a soft-sectored disk this will be an index hole; in a hard-sectored disk, it will be a sectored hole.
- **Ready**: Indicates that the diskette is being correctly inserted and is up to speed.

Other signals may be introduced on various disk drives such as signals allowing fast positioning of the head after a fixed track number, or other miscellaneous commands and status signals. However they are not indispensable, and the above set of signals can be qualified as being typical of virtually every disk drive.

The controller board

The controller board accepts software commands from the program in execution, decodes them, and manages the disk drive in such a way as to produce the required operation. When a controller simply accepts orders, such as "access specified track and sector," it is then called a "dumb" controller. Whenever a controller is equipped with its own sophisticated software capabilities, such as a file management system, it is termed an "intelligent" controller, in the same way that a dumb display is opposed to an intelligent display. An "intelligent device" is one that can decode complex commands it receives both on input and on output.

The controller is responsible for formatting the disk. In the case of a standard floppy disk the formatting will follow the IBM 3740 style and the controller will be responsible for creating the appropriate structure of gaps, identifiers, and data blocks, terminated by CRC characters. Typical commands to a controller will be:

- **Initialize.**
- **Format the Disk**: Creates the IBM 3740 format.
- **Seek**: Proceeds to the specified track.
- **Read**: One sector or sometimes a whole track.
- **Write**
- **Status**: Obtains disk status for the drive.

The controller is responsible for seeking the track, finding the sector, verifying the correct identity, and then transferring the data into or out of the sector. It will also check the CRC character at the end of every block.

"Dumb" controller boards do not require a significant amount of logic and will often use a floppy disk controller-chip (FDC). "Intelligent" controllers will typically use microprocessors to obtain required software intelligence and provide on-board buffering as well as file management facilities.

Finally, all boards include a data separator PLO (phase locked oscillator) which splits the clock and data bits, coming out of the disk, into separate signals.

The Western Digital 1771/1781 floppy disk controller chips

The 1781 is a new, double-density version of the older 1771, and is second-sourced by National Semiconductor. It provides the required formatting for standard floppies. The 1771, or the 1781, functions in the microprocessor system as a set of registers. The 1771 appears as an array of six registers. These registers are the sector and the track registers which contain obvious information; such as the status register, which can be read by the microcomputer; the command register, which has to be loaded by the microcomputer and specifies the mode of operation; and the data register, which holds the data being assembled from the disk or being shifted into the disk. A separate data shift register is also available which assembles the 8 bits being received from the disk drive.

Programmable controls for such chips include track-to-track stepping time, head settling time, head-engage time, and motor-control parameters.

The chip manages and provides most of the signals required by the floppy disk drive. It connects in the usual fashion, to the data, address, and control bus of the computer. In addition, it contains an internal CRC logic generator which can compute the CRC character necessary at the end of every block. The chip will also verify the integrity of data during a read operation.

A modest amount of additional logic is needed on board to control data transfers and provide additional control signals; such as remote eject, or drive select. In addition, usual decoding logic is required to decode the controller address and interface to the microprocessor busses.

Other floppy disk controllers are available from a variety of manufacturers. All of them are compatible with the IBM 3740 format, and usually, they are adapted to the microprocessor being manufactured by the company (Intel, Motorola, or others). Each one may offer different commands; such as "seeking automatically track 0," "multiple sector commands," or "free format commands."

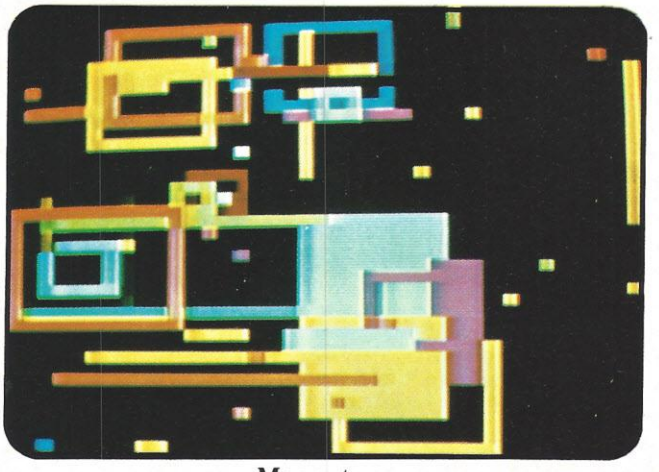
The intelligent FDC. The intelligent floppy disk controller provides software functions which normally have to be implemented in the microcomputer system itself. These functions are accomplished by using separate microprocessors on the controller boards. Typically an intelligent FDC will provide a file management system with symbolic filing and automatic space allocation on a diskette. It will also provide full editing capabilities and full input-output buffering as well as a variety of optional interfaces. In addition the usual access methods will be provided; such as sequential, random or direct accessing. Sophisticated error corrections and order retry for soft errors may also be available on some controllers, as well as explicit diagnostics.

Summary. Disk interfacing is quite simple in principle. The disk drive is equipped with minimum electronics needed to manage the few control signals it generates. These control signals allow an external controller board to sense the mechanical and electronic status of the drive and provide the required orders to position the head over the required track and sector. Because the formatting of the disk itself, is well rationalized in the case of IBM-compatible diskettes, it has been implemented in single chip disk-controllers. A number of additional facilities are desirable to provide easy interface with the user program. Ideally the user software should be able to specify any file name and have all functions taken care of automatically. This is performed by an intelligent disk controller.

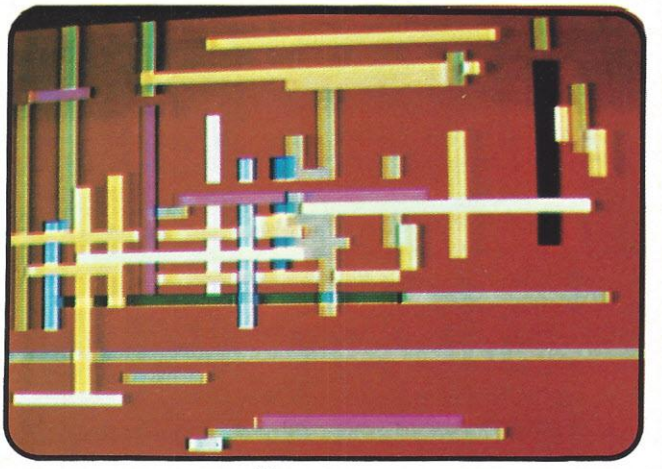
The set of commands usually available in a disk-operating system varies widely with the manufacturer. However, recently, CP/M (trademark of Digital Research Corp.) has become a virtual standard in the hobbyist world and is likely to be widely used in the future as it makes disk-based program files compatible.

Apple II
Artist Extraordinaire

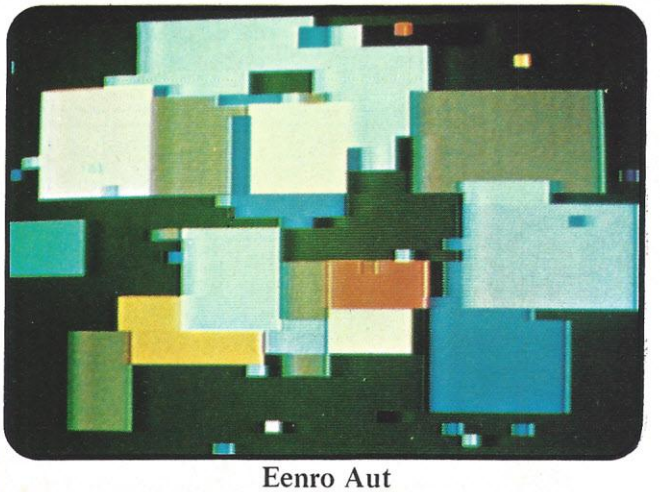
BY RAYMOND T. VIZZONE



Menautese



Erronomen



Eenro Aut

After receiving my Apple II microcomputer, I became convinced that I could use its color graphics capability to create pop-art images on my color television-now-CRT. So, with the help of an associate, I set out to produce a computer art program.

Our initial attempts were exciting but we knew that more could be added. Not satisfied with mere random colors, patterns and mixes thereof, we decided to make the Apple II appear at least a little intelligent. With a sprinkle of state diagram theory and some software experience, ARTPAC.3 was born.

ARTPAC.3 produces pop-art images and modifies them in relation to a viewer's interaction. Five elements form each image: background color, primary and secondary color, pattern mix and number of patterns. The five patterns consist of: single dot, vertical line, horizontal line, open rectangle and closed square. All five elements are affected by the viewer's rating, 0 through 10.

A sixth element, the name of the art work, is not affected by the viewer's rating. These names are made from a list of three-letter syllables assigned to a data array. Three of these syllables, chosen at random, are assembled as the name of the pop-art image and displayed below the graphic screen. (The Apple II can scroll four lines of text below the graphic picture.)

We incorporated a state diagram to allow viewer interaction with the Apple II while using ARTPAC.3. By limiting the number of different shapes to five, we were able to write and code a simple state diagram. This state diagram defined each of the five shapes as a state and allowed each state to have only two transition vectors out of the state. In this way, there could be only ten vectors. Changing these vectors to point to different states would result in a different mix of shapes. Hence, rating the picture a "0" would change zero vectors while a rating of "10" would change all ten vectors. A simple state diagram is shown in Figure 1.

A 5 x 2 matrix is required to implement this state diagram. This matrix, as shown in Figure 2, lends itself to a linked list structure. Depending on a random selection, either a transition T_1 or T_2 is chosen. Combined with the current state, a new state transition is derived. This transition link describes which shape is to be drawn next. Thus with each transition a new current state is set and further transitions are made from it.

A user's interaction causes "n" number of transition vectors or links to change, depending on the rating given. Randomly chosen, these "n" number of links are changed to point to randomly chosen states. A check is made to insure that these randomly chosen links point away from their respective states. If this check fails, the process of changing these links is repeated.

Colors and number of shapes are dealt with on a more random basis. Both are affected by the rating but are more randomly affected than the pattern-mix state diagram. The following equation describes the method used to decide the number of patterns:

$$S = S + RND\,(RTE * RTE) - ((RTE^2)/2)$$

This equation provides that the num-

ber of patterns (S) has the same chance to increase as it does to decrease. The amount the number of patterns (S) changes depends on the viewer's rating (RTE).

Each picture has a primary, secondary and background color. Depending on a rating given by a viewer, one, two or all three of the above can change. The change in these colors is chosen randomly.

Each picture is an original. With your ratings, the Apple II can get a feel for what you like and produce a suitable color and pattern mix, tailor made for you. Lines 1 - 11 are for initialization. In line 1, all of the subscripted variables are declared. TERS$ (I) holds a list of three-syllable sets which are randomly picked and placed in A0$(I), A1$(I) and A2$(I) to form the name of the "masterpiece". Lines 3 - 6 initialize subroutine names to program line numbers.

Lines 7 - 11 initialize the model to be used for the first run of ARTPAC.3. A primary and secondary color are picked randomly along with a number of patterns to be drawn. A state diagram is made, setting up the transition vectors to point to other states. As the viewer interacts, these attributes are affected more by a given rating than the randomness by which they were chosen initially.

Lines 20 - 25 are used as the main program. Line 20 is a pause used to slow down the drawing of each picture. Lines 22 - 23 count the number of patterns drawn. Lines 24 - 25 call upon subroutines to produce graphic patterns on the CRT.

Lines 100 - 560 are the subroutines for drawing the five pattern types. As each different pattern is drawn, a variable COUNT is incremented. This variable is compared to S, which is the limiting variable used in controlling pattern saturation. When S equals COUNT, the program drops down to line 600 where the clean-up work occurs. Then, the artwork is named and a viewer's rating is asked for.

Lines 1010 - 1060 use rating variable RTE to change primary, secondary and background colors. Line 1030 calls subroutine GETS to determine pattern saturation.

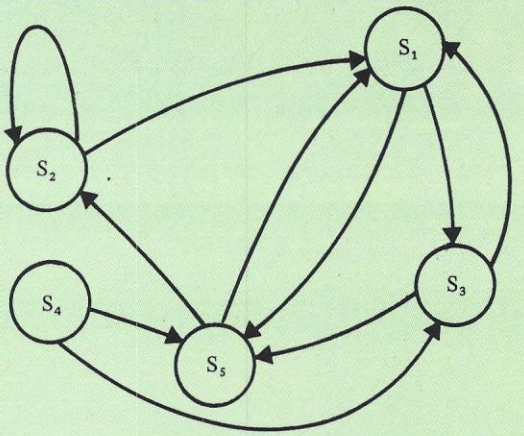
Lines 1200 - 1250 determine colors used for each pattern drawn on the screen. Lines 1300 - 1330 determine the primary color while lines 1400 - 1430 determine the secondary color.

Lines 1500 - 1520 determine the pattern saturation using the viewer's rating. The pattern saturation variable S has the same chance of either increasing or decreasing, depending upon randomness and the viewer's rating. The equation for determining S is in line 1500.

Lines 1600 - 1740 display the banner describing ARTPAC.3. This banner is displayed once at the beginning of the program.

Lines 1750 - 3040 contain the meat of the program. The subscripted array MODEL(I) is built here. As MODEL is changed, each transition vector is checked to insure it will point away from the affected state. When MODEL is completely built, program control returns to the main program via line 22.□

Figure 1



S_1 = Vertical Line
S_2 = Dot
S_3 = Horizontal Line
S_4 = Open Rectangle
S_5 = Closed Square

Figure 2

	T_1	T_2
S_1	S_3	S_5
S_2	S_2	S_1
S_3	S_1	S_5
S_4	S_5	S_3
S_5	S_1	S_2

Program Listing

```
 0 REM ***COPYRIGHT R. T.  VIZZONE &
   D. J.  CORNALI (C) 1977 CREATIVE C
   ONSULTING***
 1 DIM TERS$(70),A1$(3),A0$(3)
   ,A2$(3)
 2 TERS$="IONERROTOESEORGANDTHEIONE
   ENERT DURO EREUCKIS DIEAUTERETHE
   QNOATCMENMAN"
 3 CLRIT=1200:GETPRIM=1300:GETSEC=
   1400
 4 GETS=1500
 5 BANNER=1600: DIM LASTJ(10)
 6 DIM MODEL(10),TFLAG(5):PICKTRANS
   =3000:MODELCHANGE=1750
 7 NXTSTE= RND (5)+1
 8 GOSUB GETPRIM: GOSUB GETSEC
 9 CALL -936
10 GOSUB BANNER
11 S= RND (80)+20: GOSUB MODELCHANG
   E
12 GR
20 FOR WAIT=1 TO 100: NEXT WAIT
22 COUNT=COUNT+1
23 IF S=COUNT THEN 600
24 GOSUB CLRIT
25 GOSUB PICKTRANS: GOTO NTRANS*
   100
100 REM  HORIZ LINE
105 X1= RND (20):X2=X1+ RND (20
    )+1
106 Y= RND (40)
110 COLOR=CLR
120 HLIN X1,X2 AT Y
130 GOTO 20
200 REM  VERT LINE
205 X= RND (40):Y1= RND (20):Y2=
    Y1+ RND (20)+1
210 COLOR=CLR
220 VLIN Y1,Y2 AT X
230 GOTO 20
300 REM  POINT
305 X= RND (40):Y= RND (40)
```

Program Listing continued

```
310 COLOR=CLR
320 PLOT X,Y
330 GOTO 20
400 REM  SQUARE
405 S1= RND (30):S2= RND (30):L=
     RND (11)
420 HLIN S1,S1+L AT S2
430 HLIN S1,S1+L AT S2+L
440 VLIN S2,S2+L AT S1
450 VLIN S2,S2+L AT S1+L
452 PRINT ""
460 GOTO 20
500 REM  RECTANGLE
505 X0= RND (30):Y0= RND (30):W=
     RND (11):L= RND (11)
510 COLOR=CLR
520 FOR X=X0 TO X0+W
530 VLIN Y0,Y0+L AT X
540 NEXT X
550 PRINT ""
560 GOTO 20
600 PRINT "MY MASTERPIECE IS FINISHE
    D "
610 L=69
630 LOC= RND (L/3)
635 LOC=LOC*3+1
640 A0$=TERS$(LOC,LOC+2)
650 LOC= RND (L/3)
655 LOC=LOC*3+1
660 A1$=TERS$(LOC,LOC+2)
670 LOC= RND (L/3)
675 LOC=LOC*3+1
680 A2$=TERS$(LOC,LOC+2)
720 PRINT "I CALL IT ";A0$;A1$;
    A2$;". "
1000 PRINT "PLEASE RATE THIS WORK ON
     A 0 TO 10 SCALE(-1 TO EXIT). "
     ;
1010 INPUT RTE
1015 IF RTE=-1 THEN END
1020 IF RTE<0 OR RTE>10 THEN 1000

1022 IF RTE<2 THEN 1030: IF RTE=
     2 THEN GOSUB GETSEC: IF RTE=
     3 OR RTE=4 THEN GOSUB GETPRIM:
      IF RTE<5 THEN 1030
1024 GOSUB GETPRIM: GOSUB GETSEC
1025 GOSUB GETS
1030 COUNT=0
1040 IF RTE>3 THEN BCLR= RND (16
     )
1050 IF BCLR=PRIM OR BCLR=SEC THEN
     1040
1060 COLOR=BCLR: FOR Y=0 TO 39: HLIN
     E0,39 AT Y: NEXT Y
1065 GOSUB MODELCHANGE
1070 GOTO 22
1200 R1= RND (100)
1210 IF R1<59 THEN 1220:
1212 CLR= RND (16)
1214 IF CLR=PRIM OR CLR=SEC THEN
     1212
1215 GOTO 1250
1220 IF R1<39 THEN 1230
1222 CLR=SEC
1224 GOTO 1250
1230 CLR=PRIM
1250 RETURN
1300 RR= RND (16)
1310 IF RR=PRIM OR RR=SEC OR RR=
     BCLR THEN 1300
1320 PRIM=RR
1330 RETURN
1400 RR= RND (16)
1410 IF RR=SEC OR RR=PRIM OR RR=
     BCLR THEN 1400
1420 SEC=RR
1430 RETURN
1500 S=S+ RND (RTE*RTE)-((RTE ^
     2)/2)
1510 IF S<0 THEN 1500
1520 RETURN
1600 PRINT "**************************
     ***************"
1610 PRINT "*
                    *"
1620 PRINT "*               WELCOME
                    *"
1630 PRINT "*                  TO
                    *"
1640 PRINT "*               ARTPAC. 3
                    *"
1650 PRINT "*
                    *"
1670 PRINT "**************************
     ***************"
1680 PRINT "**************************
     ***************"
1690 PRINT
1700 PRINT "  THIS IS AN ORIGINAL PRO
     GRAM WRITTEN BY DEL CORNALI AND
     RAY VIZZONE,  CREATIVE CONSULTIN
     G. "
1710 PRINT "   APPLE II WILL PRODUCE
     A HEURISTIC ARTWORK INTERFACING
     WITH USER TASTE. "
1730 FOR WAIT=1 TO 1750: NEXT WAIT
1735 CALL -936
1740 RETURN
1750 REM  MODELCHANGE SUBR
1760 IF INITIALIZED THEN 1915
1770 FOR I=1 TO 5:TFLAG(I)=0: NEXT
     I
1780 FOR I=0 TO 4
1790 FOR J=1 TO 2
1800 T= RND (5)+1
1810 TFLAG(T)=TFLAG(T)+1
1820 ROWCOLUMN=(2*I)+J
1830 MODEL(ROWCOLUMN)=T
1840 NEXT J
1850 NEXT I
1860 FOR I=1 TO 5
1870 IF TFLAG(I)=0 THEN 1770
1880 NEXT I
1890 FOR I=1 TO 9 STEP 2
1900 IF MODEL(I)=((I+1)/2) AND MODEL(
     I)=MODEL(I+1) THEN 1770
1910 NEXT I
1911 INITIALIZED=INITIALIZED+1
1915 IF INITIALIZED=1 THEN 2090
1920 IF RTE=0 THEN 2090: FOR I=1
      TO RTE
1930 J= RND (10)+1
2000 NEWTRANS= RND (5)+1
2010 IF NEWTRANS=MODEL(J) THEN 2000

2070 MODEL(J)=NEWTRANS
2080 NEXT I
2090 INITIALIZED=INITIALIZED+1
2095 RETURN
3000 REM  PICKTRANS SUBR
3010 L= RND (2)
3020 NTRANS=MODEL((NXTSTE)*2-1+L)

3030 NXTSTE=NTRANS
3040 RETURN
```

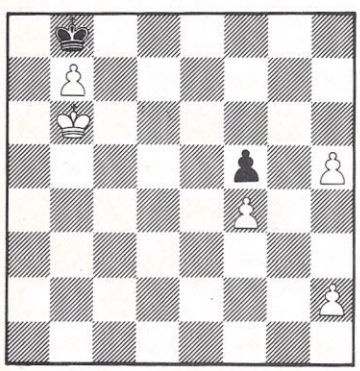
COMPUTER CHESS
including
COMPUTER CHECKERS

HARRY SHERSHOW – Dept. Editor
MORRIS MILLER – Chess Annotater

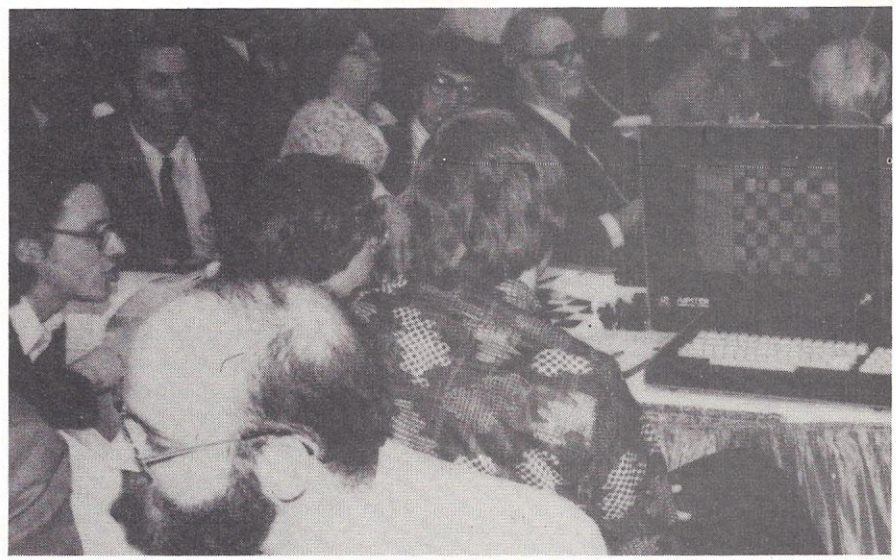
"A Little Bit is a Little Better"

A game at WASHINGTON's ACM Chess Tourney that attracted much interest was the one in which Kathe Spracklen's 1-year-old SARGON II (on a Jupiter 3 microcomputer) faced up to Tony Marsland's 10-year-old AWIT, (on an Amdahl 470 V6 macrocomputer.) It was at first considered a mismatched game and a few people said it should have been conceded to the Amdahl on physical strength alone. The differences between the two contestants were dramatic: Dan Spracklen carried the Jupiter computer into the tournament hall in his arms; Tony Marsland's Amdahl computer was bolted permanently to the floor of an air conditioned computer room at the University of Alberta, in Edmonton. It would have taken a team of riggers two weeks, using heavy-duty equipment, to move the giant machine one inch. Other differences: the Amdahl used a high-level programming language called ALGOL-W while the Jupiter spoke in the primitive dialect of Assembly Language. In memory capacity the superiority of Amdahl was staggering: Jupiter had the comparative equivalent of a single small pocket dictionary to draw upon while Amdahl had an entire set of Encyclopedia Britannica. The advantage was 50 to 1 in favor of the big computer. One could list further tremendous differences between the two computers. Why, then, did the smaller computer beat the larger one?

White- *SARGON II* Black- *AWIT*



White to move and shine like a grandmaster



Kathe and Dan Spracklen watch developments on their Jupiter CRT as SARGON battles AWIT in one of the pivotal games at the Washington Chess Tournament. Tony Marsland (facing camera) doesn't appear too happy as he watches his AWIT program go down to defeat by a microcomputer program. Grandmaster Robert Byrne, in background, watches the display board on the stage with great interest. It was the first time that Byrne, Chess Editor for the New York Times, has been involved with computer chess.

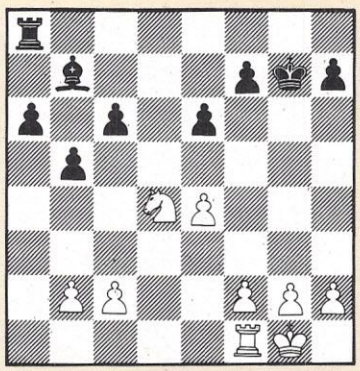
Many said it was because of the excellence of the SARGON II program, which, at the 62nd move, pulled off a little gem as shown at left.

At this point, SARGON could have chosen the apparently safe move of advancing a pawn toward the Queening rank. But this would have led to an instant stalemate. Instead, SARGON, using half of its allotted time of 3 minutes made the remarkable move for a computer of King to B6, thus avoiding an immediate stalemate. It was an amazing demonstration of the computer's ability to look ahead and demonstrated that computer programs, notoriously weak in the end games, had matured and were now able to make winning decisions in the concluding part of a game. The complete game is documented below. Included are annotations by Morris Miller and, in addition, comments by Tony Marsland, author of the AWIT program, who later re-ran the game through the computer when he returned to his computing science lab at the University of Alberta, in Edmonton.

White- *SARGON II*	Black- *AWIT*
1. P-K4	P-QB4
2. P-Q4	PxP
3. QxP	N-QB3
4. Q-K3 (a)	N-B3
5. N-KB3	P-K3
6. N-B3	B-N5
7. B-N5? (b)	P-QR3
8. BxN	QPxB (c)
9. B-Q2	N-N5? (d)
10. Q-B4	N-B3
11. 0-0	0-0
12. QR-Q	P-QN4 (e)
13. B-K3	Q-R4
14. B-Q4	BxN? (f)
15. BxB	QxP
16. BxN	PxB
17. QxP	Q-B5
18. Q-N5ch (g)	K-R
19. Q-Bch	K-N
20. Q-N5ch	K-R
21. R-Q8	RxR (h)
22. Q-B6ch	K-N
23. Q-N5ch	K-B
24. QxRch	K-N2
25. Q-N5ch	K-B

26.	Q-Q8ch	K-N2
27.	Q-Q4ch (i)	QxQ
28.	NxQ	B-N2?? (j)

White- *SARGON II* Black- *AWIT*



Position after AWIT's 28th move, B-N2

29.	R-K (k)	K-N3? (l)
30.	R-K3	R-Q
31.	R-Q3	P-QB4? (m)
32.	NxKP	RxR
33.	N-B4ch	K-N4
34.	NxR	BxP (n)
35.	NxP	BxBP
36.	NxP	B-N6 (o)
37.	N-B5	B-Q4
38.	P-KN3	B-B6
39.	N-N3	P-N5
40.	N-Q4	B-K5 (p)
41.	P-B3	B-N2
42.	K-B2	P-R3 (q)
43.	K-K3	B-Q4
44.	N-B2	P-N6
45.	N-Q4	K-N3 (r)
46.	K-Q3	K-R2
47.	P-B4	K-N
48.	K-B3 (s)	K-N2
49.	NxP	BxN?
50.	KxB	K-B3
51.	K-B4	K-K2
52.	P-QN4	K-Q2
53.	K-Q5	P-R4
54.	P-N5	K-B2
55.	K-B5	K-N2
56.	P-N6	K-N
57.	K-B6	K-B
58.	P-N7ch	K-N
59.	K-N6	P-R5
60.	PxP	P-B3 (t)
61.	P-R5	P-B4
62.	K-B6	K-R2
63.	K-B7	K-R3
64.	P-N8=Q	K-R4
65.	Q-N3	K-R3
66.	Q-R4 mate	

Annotations by Morris Miller — with further analysis by AWIT as noted by Tony Marsland:

(a) Time wasting, but the late master Jacques Mieses won many a brilliant game in the early years of this century with a similar opening: 1-P-K4, P-K4; 2-P-Q4, PxP; 3-QxP, N-QB3; 4-Q-K3.

(b) But this is not in the spirit of the opening, which calls for B-Q2 and a quick 0-0-0.

(c) Bad. By capturing toward the center AWIT could continue P-Q4, etc.

(d) *"The principal variation here was: 9. . . . N-N4 10. Q-B4, N-B3; 11. P-K5, N-Q4; 12. Q-QB4, BxN. The alternate variation was 9. . . . BxN; 10. BxB, 0-0; 11. R-Q1, Q-K2, which looks better." — Tony Marsland*

(e) AWIT should develop instead. The text weakens its Pawns. By putting Pawns on the same color as its lone Bishop the scope of that piece is cut down.

(f) A fatal mistake. Only B-K2 should be considered.
"AWIT has never won a game in which it played Q-R4. Move 13 was, therefore, a bad omen. The current principal variation was 14. . . . BxN; 15. BxB, QxP; 16. BxN, PxN; 17. QxP, Q-B5 which AWIT thinks is OK, because no debit is given for loss of Pawn in front of King. B-K2 at move 14 was probably safest." — Tony Marsland.

(g) Now SARGON overlooks a quick win: 18-N-K5, QxKP or QxBP; 19-R-Q3, etc.
"SARGON missed an opportunity here to clinch this game quickly by 18. N-N5 with any response; then, 19. Q-R6, with any response; and finally, 20. QxPch with either a mate or, if Rook has been moved, QxP mate. Interestingly, AWIT, playing Black, does not examine N-N5 for White. But when AWIT plays White, it considers and plays N-N5." — Tony Marsland

(h) *"RxR avoids the draw. The principal variation of the reply was 21. . . . RxR; 22. Q-B6ch, K-N1; 23. QxRch, K-N2; 24. Q-N5ch, K-B1. The alternate variation was 21. . . .B-N2; 22. Q-B6ch, K-N1; 23. Q-N5ch, K-R1. Recent analysis of AWIT's output suggests that a tree-search malfunction occurred. Differentiation between draws by repetition and duplicated positions at shallower depth may have been in error." — Tony Marsland*

(i) Amazing! SARGON has simplified into an ending which if anything favors AWIT: Black has Bishop against Knight and the Black Queen side majority of Pawns can be easily mobilized whereas White's extra Pawn on the King side cannot. Faulty assessment by SARGON.

(j) AWIT should play: 28- . . . P-QB4; 29- N-N3, P-B5; 30-N-Q4, B-N2; 31-P- B3, R-Q; 32-P-QB3, P-K4; 33-N-B5ch, K-B3; 34-N-K3, R-Q6; 35-R-K, P-QR4, etc. with a win for Black. While the entire continuation is beyond AWIT, the positional need for P-QB4 should not be.

(k) Directed against P-QB4, attacking Knight and Pawn, but P-KB3 was better, both to free the Rook for more important work and to make the Bishop "bite on granite" (Niemzowitsch).

(l) *"For the moment AWIT stands better, although 29. . . . P-QB4 followed by R-Q1 is preferable." — Tony Marsland*

(m) *"This interesting position has a principal variation of 31. . . . P-QB4; 32. NxP/K; RxR; 33. N-B4ch, K-N4; 34. NxR, BxP. At least another 2-ply is needed to resolve this lost Pawn situation." — Tony Marsland*

(n) *"The principal variation here was 34. . . . BxP; 35. NxP, BxP/QB; 36. NxP, B-N3; 37. N-N4, with a premature (irregular) even-ply tree termination. The alternate variation was 34. . . . P-B5; 35. N-B5,*

Playing for the Title

During the annual computer chess tournament in Washington D.C., Ken Thompson talked about BELLE and computer chess. "I think the winning method of play in computer chess has been demonstrated in the last five years," he said during the panel discussion. "Basically, and bluntly, it is horsepower. I believe that the problem of exhaustive search should be attacked by making better chess hardware. I therefore, set out to build some new chess hardware. I made about three paper designs and last year, at the world's computer chess championships at Toronto, I dug out my little tiny board. I finished in a tie for fourth with CHAOS. I had lots of problems with it but I learned some lessons. And during the last year, I built a piece of chess hardware that computes legal moves and does not burden the computer with the drudgery of knowing what kind of game it's playing. For example, it could be playing checkers, or backgammon or poker. It simply asks what side is to move and what are the moves. It does not know what the moves are or what they represent. At some point it decides — well, this is it — what's the value of that move? Having derived some value it then backs it up. The object of course is speed. This is done on what has been called a minicomputer in the past and appears to be successful. Its approach I think has approximately a factor of 100 in speed to go before things start getting tight — before more speed becomes harder and harder to get. Now there's an empirical formula that compares USCF ratings against horsepower. I'm talking about the number of nodes per second. And the formula holds from CHESS CHALLENGER and small computers all the way up to the best computer. It appears to be about 400 times the 8th root of the number of nodes examined per second. This comes out to about a factor of 100. If you believe in the accuracy of this formula then this factor should put the next chess program up around 2600. That's rather high in the scale. I personally don't believe the formula. It's never helped in the past. At every point there's some conceptual barrier that you can't pass. There's something in the human mind that's going to take over and create the barrier. The barrier, remarkably, is 50 points above the highest rated program in the entire history of computer chess. It is now at master level, which is about 100 points above the best rated programs. I personally think that there is a barrier there. Certainly it's much lower than 2600 so I don't believe that the factor of 100 will give you 2600."

While Mike Ciamarra watches the display board, David Slate follows the progress of CHESS 4.7 against . . .

. . . BELLE, with Ken Thompson at the printer. Occasionally, Ken grew impatient as moves from the computer arrived tardily.

Monty Newborn, of the OSTRICH program, later added his own opinion: "Ken feels that a factor of 100 is necessary before a level of 2600 can be reached. And the question remains how long will it be before a factor of 100 is possible? It's quite possible that it will be only a matter of a few years — maybe 3 to 5. I think that within that framework we can expect to see suitable improvement in the next 3 to 5 years."

In the second round of the four-round tourney, BELLE and CHESS 4.7 faced each other in what was to prove the focal game of the tournament. BELLE won this game, and all its others, and went on to the championship. CHESS 4.7, the loser, finished the tournament in second place as this turned out to be its only loss.

B-B3; 36. P-QN4, P-KR4; 37. P-QB3, P-R5. Pawn to QB4 was rejected because of improper knowledge about Pawn recaptures on the 6th rank." — Tony Marsland

(o) Although a Pawn down, AWIT should not lose the game.

(p) *"Both the principal variation (B-K5) and the alternate variation (B-QN2) subsequently involve double Bishop moves. In its tempo penalty, AWIT makes no distinction between forced double moves and voluntary ones." — Tony Marsland*

(q) The rule in such situations is the party with lesser material should avoid moving Pawns, but try to temporize.

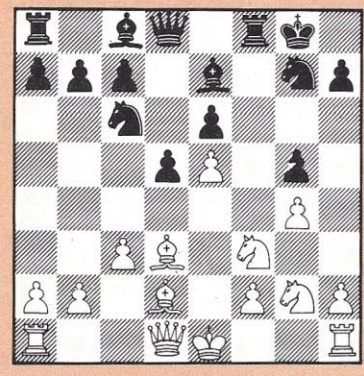
(r) *"AWIT's failure to consider 46. . . . K-Q6 was disastrous. The problem seems to stem from restricted King mobility since K-K7 and and K-KB7 were examined. The apparent dithering comes from a difficulty in handling trapped pieces. The move of NxP can be applied at any time and so the 'block passed Pawns' plan is not invoked. The principal variation was 47. . . . K-R2; 48. K-B3, K-N2; 49. P-R3, P-B3; 50. P-KN4, B-N2. But the game is completely lost at this point." — Tony Marsland*

(s) Evidently SARGON has been programmed for, and plays the ending well.

(t) *"The game was resigned after this move. However, it was continued to the mate-ending at SARGON's request. During analysis of the game, there were six SARGON moves that AWIT did not examine: Moves 30, 38, 39, 46, 47 and 53." — Tony Marsland*

White: **BELLE**	Black: **Chess 4.7**
1. P-K4	N-QB3
2. P-Q4	P-Q4(a)
3. N-QB3	P-K3(b)
4. N-B3	B-N5
5. P-K5	KN-K2(c)
6. B-Q2	N-B4
7. N-K2	B-K2
8. P-B3(d)	0-0
9. N-B4(e)	P-KB3
10. B-Q3(f)	PxP
11. PxP	P-KN4
12. P-KN4(g)	N-N2
13. N-N2	P-QN3
14. Q-K2	B-N2
15. R-KN	P-QR4
16. P-QR4	K-R
17. P-KR3	K-N
18. R-R(i)	P-KR3
19. P-KR4	P-Q5(j)
20. PxNP	N-N5(k)

White: **BELLE** Black: **CHESS 4.7**



Position after BELLE's 13th move (N-N2)

21. PxRP	NxBch(1)
22. QxN	PxP
23. Q-N6	PxBch
24. NxQP	R-B2
25. PxN	RxNP
26. QxKPch	R-B2
27. Q-R6(m)	R-N2
28. Q-R8ch	K-B2
29. P-K6ch	KxP
30. QxR	BxN
31. R-R6ch	K-Q2
32. 0-0-0	B-Q4
33. N-K4	K-B(n)
34. R-R8	BxN
35. R(Q1)xQ	BxR
36. Q-K7	K-N2
37. QxBch	K-R2
38. R-N8	R-N
39. P-N5	B-K2
40. RxR	BxNPch
41. P-B4	BxPch
42. QxB	KxR
43. K-Q2	K-N2
44. K-Q3	K-B
45. P-N4	PxP
46. QxP	K-Q2
47. Q-N5ch	K-Q
48. K-K4	Resigns

Annotations by Morris Miller

(a) An idea of Niemzowitsch, but it often took a Niemzowitsch to make it work.

(b) Better than 3- . . . PxP; 4-P-Q5. Black now has a French Defense but with the drawback P-QB4, the natural freeing move, cannot be easily achieved.

(c) If 5- . . . P-B3; 6-B-KB4 with an edge.

(d) Black could now try 8- . . . P-B3; 9-B-KB4, P-KN4:
A: 10-B-N3, NxB; 11-RPxN, P-N5; 12-PxP, BxP; 13-N-Q2, P-K4.
B: 10-PxP, BxP; 11-B-N3, NxB; 12-RPxN, P-K4.

(e) To hold the center, Belle might try 9-P-KN4, N-R5; 10-NxN, BxN; 11-N-N3, P-B3; 12-P-KB4 although this is somewhat risky.

(f) And now Chess 4.7 must play N-Q3.

(g) Otherwise the KP goes by P-N5.

(h) Chess 4.7 misses this exciting continuation which gives good chances: 13- . . . RxN!?; 14-QxR, NxP; 15-Q-K2, NxBch; 16-QxN, P-K4; 17-P-KR3, N-K3, etc. However, this is a nine-ply continuation.

(i) Both programs seem to have gotten into a "hiccoughing syndrome."

(j) At last an idea. Best for BELLE is B-K4.

(k) If now 21-B-K4, P-Q6 wins.

(l) Why not BxN?

(m) Another win is 27-0-0-0, B-QB, 28-R-R8ch, KxR [or K-R7, R-R7ch].

(n) If 33- . . . P-QB3; 34-R-Q6ch.

A Chess Program, PartX

This complete dissertation by Mike Valenti on how to write a computer chess program is presented in monthly sections as a guide for those wishing to write their own programs. Although designed to be run on a large computer, this program with proper modifications can serve as a model in writing a chess program for smaller memory-systems — even the microcomputer. This program is written in BPL (modified XPL), but it can be written in other languages as well — with proper transitions.

The look-ahead routine generates a game tree whose size depends on game parameters passed to it (maximum depth, widths at each level etc.), the amount of time left on the game clock, and whether or not special moves are to be added for consideration to a given depth. The parameters controlling these (except time control) can be changed or displayed using some commands explained later. Also, if all of the moves considered in look-ahead return values worse than some specified (and adjustable) value, look-ahead is done for the next "N" best moves, where "N" is the width of search specified at the first level.

Typically, the depth is set to 4 after the first level, namely five ply, in a tournament game, and the widths are set, from the first level, to 7, 5, 3, 2 and 1. All searches must be to an odd-number of ply at this time. The change-depth command uses the depth after the first level, and therefore an even number must be specified, one less than the total ply desired.

Another command that is used spec-

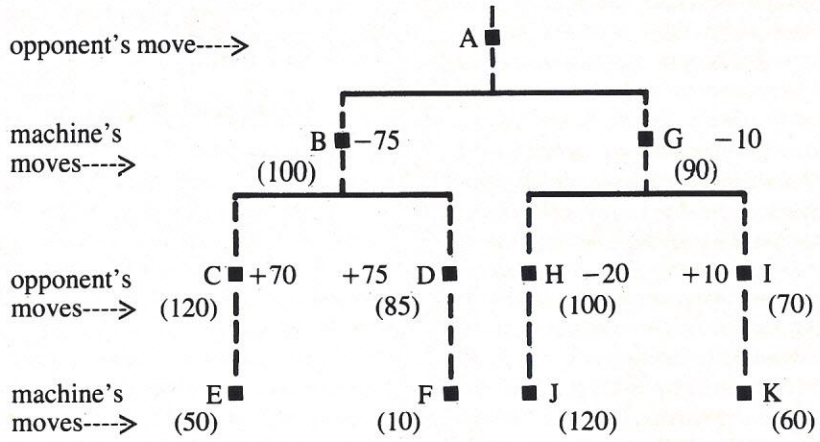
ifies that the width can be extended up to a certain depth in the tree by the inclusion of "special" moves. Typically, the width is extended at the first two levels of the tree. These "special" moves include castling, passed pawn moves, all captures at the first two levels of the tree, and uncovering damaging attacks on enemy pieces. The moves are flagged "special" as they are recognized as such, in the heuristics.

The depth can be modified, and "special" moves can be considered at lower levels of the game tree by use of certain commands. Details of this will be explained later in the routine called PRE_LOOK_AHEAD.

The heuristics assign scores on a per-move basis, and it is these scores that are used to select optimal move. The best move is chosen as the one that contains the path with the highest total of per-move scores. The move scores are added for the machine's moves in the path, and subtracted if it is an opponent's move. It is assumed that the opponent will make the move to maximize "his score minus the machine's score". The example in the figure illustrates this technique.

This figure shows a three-ply tree with the original heuristic assigned values in parentheses, and back-up adjustments. The backed up value at B is thus 25 and at G is 80. Therefore, the computer selects G as its response. This procedure can be applied to any odd-ply depth. The tree would be printed as below, only with moves replacing the letters A through K. B and G print scores after they have been backed up, and these replace the original scores of 100 and 90, respectively.

THE LOOK-AHEAD PROCEDURE



TREE AFTER A:

---B(25)---C(120)--E(50)
*-------D(85)---F(10)
---G(80)---H(100)--J(120)
*-------I(70)---K(60)

Because the exchange evaluation procedure is not completely accurate, sometimes a capture can be made that may look even, but actually leads to a material advantage. For this reason, material balance is checked during the tree generation and scores are adjusted, if necessary.

There are also heuristics explained later in the look-ahead that look for things such as, successive moves with the same piece, or undoing a move.

At present, there exists an elementary opening-moves book design for this program to make quick moves at the start and also to throw other computers out of their books. A flag is used to indicate to the computer that it is in the book, whenever the board is initialized to the standard starting position. As soon as a non-book move is made, or a book line of play terminates and no other line of book play can be used, this flag is turned off, and the book is no longer used. The book-moves used to frustrate other computers' books are explained later in the two sample tournament games.

Chess Chatter

During December's 9th Annual Computer Chess Tournament in Washington, a small controversy erupted. The Cray-1 machine, touted as one of the most powerful computers in the world, and used to simulate thermonuclear bomb blasts, decreasing the need for actual testing, had been promised to three different chess programs for use during the tournament. The announcement stirred up much excitement among the prospective participants because it was the first time the Cray machine would be seen in a public demonstration of its "power". At the tournament it would be measured against other giants; such as, Control Data's Cyber 176. It also raised the intriguing question of which program would win, if three of them were run simultaneously on the same machine. However, these questions were never answered. Several weeks before the tournament began, the Cray company announced that its machine would not be available for the tournament. The most disappointed participant at the tournament was Bob Hyatt of BLITZ 6.5. Bob believes that his BLITZ program is the best in the field and with the increased computing power of the Cray machine at his disposal he felt that BLITZ 6.5 would be unbeatable. For the tournament, Bob used a Univac 1100/42 located at one of the government agencies in Washington. BLITZ 6.5 played against BELLE, which won the game, and BLITZ 6.5 had to settle for a third-place tie, behind second-place finisher, CHESS 4.7. There were conflicting rumors as to why the Cray machine was withdrawn. Some rumors hinted that corporate jealousy would not permit Cray to be entered for fear that it would not win the tournament

and its claim to "world's strongest computer" would be challenged. Other rumors implied that Sperry Univac, which was to serve as interface between the chess-programs and the Cray machine, could not reach an agreement with the Cray group. A note of inquiry to Carl Hammer, Director of Computer Sciences for Sperry Univac in Washington, brought the following explanation from Carl: "On the subject of a proposed linkup between the Cray and Univac machines for the chess tournament, it would be interesting to learn how 'many different versions' were bandied about. Actually, there were no problems; it was just that we were unable to re-arrange the tight schedules on our machines to meet the extensive tournament requirements. There are no plans at this time to connect our two machines during future computer chess tournaments. However, such a linkage could certainly be considered."

Some of the characteristics and background of the Cray-1 computer, as outlined by Paul Snigier, of DIGITAL DESIGN, (sister publication of PERSONAL COMPUTING) are staggering. "Cray-1 is five times more powerful than the Cyber 76," writes Paul. "And it is equivalent to five IBM 370/195s. Its price tag of $8,000,000 makes it the most expensive computer in the world. Characteristics of the Cray-1 include: 12.5 nsec clock period, 50 nsec cycle time, 64-bit word length, 1,048,576 word memory, and an 80 million words/sec memory bandwidth. Time required to read or write data in memory is 50 nsec. Seymour Cray, legendary computer genius, was one of the founders of Control Data and was partly responsible for its success story. He designed CDC's 1064, 6600 and the 7600 (Cyber 76) computers. He left Control Data in 1974 to found the Cray Research Company with 12 designers from Control Data and with CDC's backing. Although the two have become separate activities, there remains a friendly relationship between Cray and CDC. Seymour Cray predicts that future computer performance will quadruple every five years and the big advances will come when supercomputers incorporate LSI and VLSI chips (Cray-1 does not use LSI.)"

It is little wonder, then, that so many computer-chess programmers are anxious to test their algorithms on the Cray colossus.

LOOKING FOR FACTS

. . . "Chess-playing micros are proliferating in the New York City stores," writes Richard M. Wilcox, of 400 Second Ave., New York, NY 10010. "The demand for newer chess machines is so great that there is a considerable backlog of orders before the new models are even on display. The field is quite competitive with a notable increase in program sophistication during the past year. It is unfortunate, considering the substantial price of these models, that there is so little information available about these machines to guide potential purchasers. One must rely on the highly exaggerated claims about strength of play put out by promotional literature and by over-eager store salesmen. I would like to see more information on these programs in order to avoid some of the disappointments typified by the recent letter from one of your readers, Charles Derr. Some of these models may be a delight for the beginner or novice but a bitter disappointment to an experienced player. Considering the price of these units, I believe more information should be made available concerning the hardware and general nature of the program, including basic strategy and methods of tree searching. It would be particularly helpful to know the approximate depth of search at various levels of play. This could be done without giving away any trade secrets and would certainly add to enjoyment of the product." (See the news on the Penrod Memorial Chess Tourney.)

"POSPYESHITYE!"

. . . Time is running out for anyone still thinking about joining Shelby Lyman's Chess Tour to Russia, which is scheduled to leave May 30th. "The Russian Gambit" tour will take the traveler from New York to Helsinki, Moscow, Tbilisi, Sukhumi, Leningrad and back to New York during the 15-day trip. On the program are scheduled visits to Soviet chess clubs and invitational games aginst Russian chess players in clubs, parks, factories, universities, Friendship Houses and Pioneer Palaces. The tour will sit in during a chess class and will be permitted to discuss theories and methods with some of the Soviet instructors. Chess is a serious national game in the USSR with more than four million players registered in the 1600 workers' clubs. The Soviets have also been developing computer-chess programs since the mid-50's, and this activity, too, will be explored. If you want to go to the land of caviar and vodka dash off a quick note today to CITIZEN EXCHANGE CORPS, 18 East 41st Street, New York, NY 10017. "Pospyeshitye!" (That means "Hurry Up!" in Russian and is pronounced "poss-peh-cheetah".)

A KNIGHT'S TOUR

. . . The Knight's Tour problem, which appeared in the December issue, has brought the following response from Gary Carlson, Director of Computer Services at Brigham Young University, 167 TMCB, Provo, Utah, 84602: "For some time I have given a student assignment to solve the Knight's Tour in a course on Computer Applications in the Behavioral Sciences. Typically, about one half of the students solve the problem and write the program that will get a successful 64-square solution from any starting point on the board. My students have written solutions to this in Fortran, Assembly, APL, etc. Some of the students, having solved the problem, then tackle related problems; such as, making the shortest possible program, or the fastest processing program, etc. Also, the students have been able to generalize the problem so that they can get a successful solution on an N by M board. Typically the programs are written in Fortran and run under Watfor at an average cost of 10¢-15¢ per run. I have used this problem for many years because it is an intriguing one; and if one conceptual breakthrough occurs, a generalized solution can be found. I use this example because when the students find the solution, there are truly 'Eureka!' type of phenomena following the discoveries. It's exciting to watch a student enjoy a

moment of discovery in his college career, because much of his experience is not in that mode at all; but rather, it is rote learning. I hestitate to submit the general solution to the problem, because it would deprive people of that delightful 'Eureka' phenomenon. If anyone is interested in the solution, I'd be happy to share it with them if they will write to me. It is interesting that the Knight's Tour is an ancient problem, having been studied by the monks in the medieval ages. Up until the mid-1800's people were convinced that there was no generalized solution. We currently have operating programs that have generalized solutions for almost any size or shape of the board."

ANOTHER KNIGHT'S TOUR

. . . Another comment on the Knight's Tour comes from Joe Linn of 1621 Birmingham Street; St. Paul, MN 55106: "There are two main problems with your program as shown: 1) it is very slow due to its trial and error approach, and 2) it does not hit all 64 squares. Fortunately there is a method for solving this problem without this extensive iteration. Always move to the square from which you will be able to make the fewest possible moves. I wrote a program in TRS-80 Level II BASIC which will quickly hit all 64 squares for any given starting location. After working with this for awhile I discovered that I could modify one of the tours so that the Knight would return to the same square from which it started. This proves that the full Knight's Tour can be done from any starting location. All you have to do to start from a different square is begin anywhere in that sequence, jump from 64 to 1 and return to your original starting square. That tour is shown below."

36	63	14	43	38	7	12	9
15	44	37	60	13	10	39	6
62	35	64	47	42	53	8	11
45	16	61	56	59	48	5	40
34	57	46	1	52	41	54	23
17	28	31	58	55	22	49	4
30	33	26	19	2	51	24	21
27	18	29	32	25	20	3	50

CLAIMERS AND DISCLAIMERS

. . . Evan Katz, of 61 Tara Drive, Roslyn, NY 11576, is delivering a talk and comparative analysis on computer chess during the PERSONAL COMPUTING FESTIVAL of the National Computer Conference in New York, June 5-7. "Rumors have come my way," he writes in a recent letter, "that BORIS is now 40% faster and that David 'Chess' Slate and Larry '4.7' Atkin are providing somevaluable consultation. I am sure they will improve BORIS with their immense programming knowledge. The latest material I have received from Chafitz Company says that BORIS defeats CHESS CHALLENGER 10. It would be interesting to see some documentation of that statement and find out which BORIS model they're talking about. Recently I had the privilege of playing against COMPUCHESS. In ten words, 'it does not play a good, tournament game of chess.' At least, not yet. Microchess 1.5 for the TRS-80 is a good effort by Peter Jennings with its limitation of 4K memory. This program has some book openings and an OK move selection. But the graphics are poor, it offers only three levels, and there is no way to set up selective positions. If they would come out with a 16K program for the TRS-80 I would snatch it up quickly, assuming that the program and look-ahead were better than in the 4K version. I am still waiting to hear about Commodore's CHESSMATE. Because it will be the latest commercial machine to come onto the market it should profit from all the errors and shortcomings of other consumer chess computers and, hopefully, will be a strong player. I await its arrival."

PENROD TOURNAMENT

. . . Don Gerue tells us that the second annual Penrod Memorial Chess Tournament will begin on September 15th. CHESS CHALLENGER 10 won the first annual tournament. However, new competition has been added to the field, in the form of additional participants, programs have been upgraded and it seems likely that a new champion will emerge. This tournament, says Don, is staged to evaluate all commercial chess-playing machines as well as programs on cassette or hard copy. The

tournament usually runs for two or three months and pits every participant against every other participant first as black and then as white. The resulting winner, emerges from an unbiased, non-prejudiced environment to claim the rightful title as being the best in the country — at least until the next tournament is run. There is currently some consideration being given to the idea of grading the computers based on their performance in the tournament. Any programmer who would like to enter his product in this competition can write to Don Gerue, 3667 Montalzo Way, Santa Barbara, CA 93105.

BELLE MEETS SARGON

. . . Kathe Spracklen (SARGON programmer) had a surprise visit from Ken Thompson, who won the 9th ACM Chess Tournament with his BELLE program. Ken brought along a portable version of BELLE in a package about one cubic foot in volume. He had put the BELLE program, already stored in a PDP 11 at Bell Telephone Labs, into a small LSI-11 16-bit processor which contained the special logic, board position analyzer and move generator that Ken uses on the big computer. A brief match was held between BELLE (on the portable unit) and SARGON II and, to no one's surprise, BELLE emerged victorious. More information on Ken's portable unit and the game itself will appear in an upcoming issue. A note from Theresa Pisacreta of Hayden Book Co., Inc., 50 Essex Street, Rochelle Park, NJ 07662 notes: "Will you kindly tell your readers that they can get information on SARGON, and can order it in cassette or in book form from Hayden. The price of the book is $14.95; the cassette for either the TRS-80 Level II version or the Apple II version is $19.95. We would appreciate your telling the readers about this, because the authors cannot fulfill any orders for the program." (Hayden's New Jersey address is shown above.)

ICCA MEETING

. . . An informal meeting of the ICCA was held during December's ACM conference in Washington. The 25 people who attended that meeting learned that the association has doubled its membership since its inception in August of 1977 and is now approaching the 200-member level. Membership is open to anyone interested in computer chess and requires only that a $5.00 fee and an application be sent to ICCA; Vogelback Computing Center; Northwestern University; Evanston, IL 60201. Although there has been no formal election of officers as yet, the organization has three temporary directors: Prof. Benjamin Mittman, of Northwestern University; Dr. M.V. Donskoy, of the Institute for Systems Studies, Moscow; and Barend Swets, from the Netherlands.

Ben Mittman opened the meeting with the question: "What should the International Computer Chess Association do beyond publishing a newsletter and having a membership list?" He then offered some answers to his own question. "There could possibly be a meeting with FIDE," he said, "and help them formulate rules and regulations for future computer chess tournaments. Another thing we can do is the possibility of establishing ELO ratings for the programs. We are going to need a set of by-laws; how often should we meet; do we need officers? Perhaps we could even have varsity teams in the universities in computer chess. Then, someday, we might see a nationally televised game where Northwestern meets McGill University in a 'Superbowl of Computer Chess.' You know, about four years ago a reporter for the Chicago Tribune, who had interviewed us on the computer-chess program at Northwestern, started his newspaper story by saying that if computer chess were a collegiate sport, Northwestern University would be a powerhouse because it was the only winning team on our whole campus that year.

"Another thing ICCA can do is lay down its own rules for conducting computer chess tournaments. So far, rules governing such tournaments are those that have evolved from discussions with Monty Newborn, David Levy and myself. These are not really official rules nor are they standard rules. As a matter of fact, at every ACM tournament we change these rules or amend them, based on our own experiences in past tournaments. Now, perhaps, through the ICCA we could have something more formal - more permanent - perhaps reflecting more opinions than the few people participating in the organization so far. Another important issue is the one of computer versus human competition. Both the USCF and FIDE are concerned about entry of computers in human chess tournaments. Should computers be allowed to compete? If they are allowed, then, - under what circumstances?"

Monty Newborn added some further ideas of his own. "I suggest having five small committees to concentrate on the various problems," he said. "The first committee, for example, would be an organizational committee, concerned with the development of ICCA. A second committee would be a rules committee and its purpose would be to come up with an acceptable and standardized set of rules to follow in every tournament. A third committee would be a ranking committee. That committee would decide whether and how to rank computers, who should be entered in the competition and similar considerations. The fourth committee would be a sanctioning committee. It would decide whether a tournament should be considered official if for example, only four participants showed up. And the fifth committee would be a monitoring group. It would organize and supervise the actual computer-chess tournament and would establish rules that would govern the successful operation of the whole affair."

Some additional observations were offered by Barend Swets: "There are always problems that arise at computer-chess tournaments," he said. "During the First European Championship, for instance, there was a great difference in languages and a problem in communication. From talking to many people in Europe, I can tell you they all like the idea of an international organization in computer chess, because it is, already, an international activity, almost, you might say, like the Olympics. I feel it is very important to keep up communication between all interested parties. A news letter, such as the one Ben Mittman is now getting out, is an excellent way to do it. Another thing is - people might ask if we really need a computerchess organization? I would

say yes. You can see how our organization is developing and how fast micros are beginning to become involved. If you don't have an organization now then there is sure to be one in a few years. There are many people in Europe who want to be informed of developments in computer chess. Also, when there are computer chess tournaments organized anywhere in the world — this year in Holland — people don't know who to ask, where to go, or how to participate. There should be an organization telling them what tournaments are coming up, how to enter them, who is sponsoring them, who will be there, and so forth. I like Monty's idea of having different committees to deal with different problems. In Europe, I would like to add, a lot of people try to get a copy of all the games that were played and they do not succeed and they ask me - please send the games. But that's impossible for me to do. So I think it's a good idea to have the newsletter print a set of all the games after they are played. No annotations. Simply the results and the games. Right now, people who are interested cannot get these games."

Someone stood up at that point and declared, "Let's appoint Ben Mittman as permanent chairman of the ICCA!" Everyone said "Yay!" But Ben retorted: "I appreciate the honor. But I've got so many chairmanships running now I really don't have room for another one. Let's have these different committees that Monty Newborn mentioned and not have just one man do it." Another round of "Yay's" was heard from the group.

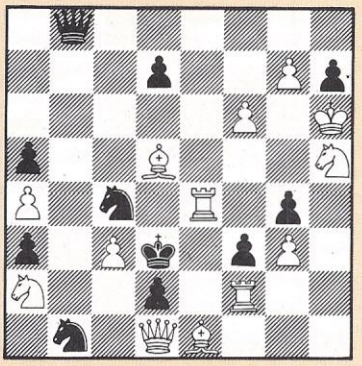
David Levy then complained about USCF's ruling that if a computer program made any changes in its program it would have to start again." It seems unfair. Because you don't ask a human player to start from the beginning again every time he improves his line of play."

This first unofficial meeting of the ICCA, came to an end at that point as an announcement arrived that the final round of the tournament was about to get under way. It was agreed, then, to adjourn until the 1979 10th ACM Tournament in Detroit.

A Romanian Afterthought

. . .The contest between Bucharest readers of the newspaper Magazinul and the Romanian Computer, Felix 256, having been concluded with a loss for the computer, our correspondent from Romania, U. Valureanu, sends along an item showing the computer in a winning mood. During last summer in Sofia, Bulgaria, an international chess-problem-solving contest was held. Among the many problems considered there was the following, which was solved in seven minutes by a human. When the same problem was later offered to Felix, the computer pounced on it and came up with a solution in 30 seconds! At least, that's what we deduced when the Romanian dispatch was translated into English.

White to play and win



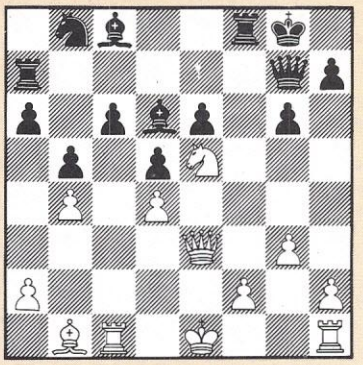
(Answer elsewhere in this section.)

Our correspondent also included a game that the Romanian computer had played against a human chess beginner. It is analyzed here by Morris Miller. There are some opinions around to the effect that the best time to study a computer program is when it is playing a neophyte. Then the program reveals its true motivations. Is it a skilled hunter who attacks his victim with animal savagry and bent only on a quick, merciless kill? Or is it only a dawdling gadfly taking a stroll across the chessboard, knocking over harmless pawns and in no particular hurry to corner its waiting victim? Morris studied the game and offers his analysis:

White: **A Chess novice** Black: **Felix 256**

1.	d2-d4	e7-e6(a)
2.	e2-e4	a7-a6?(b)
3.	B-e3?(c)	B-b4+?
4.	c2-c3	B-e7
5.	N-d2	N-f6
6.	N-f3	c7-c6?
7.	b2-b4?	0-0
8.	N-c4	d7-d5!(d)
9.	Nc-e5?	Nxe4
10.	B-d3?	Nxc3
11.	Q-b3	f7-f6?
12.	QxN	PxN
13.	NxP	B-d6
14.	B-f4?(e)	RxB
15.	N-f3	b7-b5?(f)

White: **AMATEUR.**
Black: **ASTRO 64 (FELIX 256)**



Position after black's 21st move (Q-g7).

16.	R-d1	R-a7!
17.	B-b1	g7-g6(g)
18.	Q-e3	R-f8(h)
19.	N-e5	Q-h4
20.	g2-g3	Q-e7
21.	R-c1?	Q-g7(i)
22.	NxPc6	R-c7
23.	NXN	Bxb4+(j)
24.	K-e2	e6-e5!(k)
25.	NxP	B-g4+
26.	f2-f3	Bxf3+(l)
27.	K-d3	e5-e4+
28.	QxP	BxQ+
29.	K-e3	Q-h6+
30.	K-e2	BxQ+(m)

Morris Miller analyzes the ASTRO-64 program run on a ROMANIAN Felix 256 computer.

(a) Felix gives white the option of playing either the French defense or a Queen's Pawn. This means Felix is well acquainted with the openings.

(b) Somehow all computers seem to have a built-in bias for preventing checks and giving checks, c.f. Astro's next move.

(c) White's move is not good since he may want to play B-g5, and when Felix plays N-f6, white cannot play e4-e5 as Felix will play N(f6)-d5 attacking the bishop.

(d) Forcing the exchange: 9-e5xd4, d6xe5 with a freer game.

(e) Had the amateur instead played 14-P-f4 he would have had a playable game.

(f) Felix gives itself a backward pawn instead of playing N-d7, but its reasons are interesting: to clear the seventh rank so as to play R-a7 and double rooks.

(g) Felix anticipates white's move Q-d3, limits the range of the white bishop and protects the h7 pawn with the rook at a7. Excellent foresight.

(h) Felix should double rooks. Now or later the pawn at b4 could be taken but Felix is out for bigger game.

(i) A remarkable position. Most players would be content to protect the c6 pawn and grab the b4 pawn with check, but I am sure Felix must have envisioned, if not the actual combination, the positional continuation it entails.

(j) Felix could exchange rooks and recapture at b8 but enters into a sacrifice with many ramifications which is intended to bring his dormant bishop at c8 to life.

(k) If now 25-N-c6, B-b4ch; 26-K-f1, Pxd4; 27-Q-b3, B-d2!; 28-R-c5, (not 28-Qxd5ch, K-h8 with the double threat of Bxcl and B-f6) Rxf2ch!!; 29-Kxf2, R-f7ch; 30-K-g2, Q-f6 and mate is forced after a few checks by white.
This is the *type* of positional continuation referred to in the note to Felix's 21st move.

(l) Giving white an opportunity which only a seasoned player would see: 27-Qxf3, Rxf3; 28-Rxc7, R-f2; 29-Rxf7, Qxf7; 30-Nxb4, etc.
Or: 28-. . .Q-f6; 29-Pxe5!, R-f7ch; 30-K-e1!; Q-f8; 31-Nxb4, Qxb4ch; 32-Kxf7, Qxd4ch with a wild game but white's three pieces balancing black's queen and two passed pawns.

(m) And then, writes our Romanian colleague, "Felix-Sah da mat cu Q-d2!" and chess players don't have to understand the Romanian language to know what that means.
Although the amateur's showing was expected, Felix was most impressive. Although the machine made a few errors (3rd, 6th, 11th and 15th moves) which a master would not make, Felix shows a fine positional grasp, evidently commands a respectable opening repertoire and is capable of long range planning for an attack, being ready to sacrifice material therefor.

Solution to Romanian problem:
1. Nh5-f4+ QxN
2. QxN mate

Computer Checkers

Checkers Annotations by Richard L. Fortran,
Games Editor of American Checker Federation

Notations used in annotations . . .

. . .In the comments that usually accompany checker games, some are made that are not seen in chess. Because readers may not be familiar with these particular notations, they are explained here:

1) STAR (or ASTERISK): Denotes a forced move to a win or a draw.

2) GAYP (GO AS YOU PLEASE): This free style of play is one of three styles recognized by the American Checker Federation. The first player here can make his opening move at will. This method has become more or less obsolete because of the high number of duplicate games and draws.

3) TWO-MOVE RESTRICTION: The player draws from a deck containing 37 openings. The first player must make his initial move as shown on the card he draws. The second player must do likewise. From that point on, the players are on their own.

4) THREE-MOVE RESTRICTION: This method is used by the ACF in national tournaments and matches. This "restriction" consists of 142 designated openings balloted from cards as in the TWO-MOVE RESTRICTION. The first player makes the move shown on the card drawn. The second player does likewise. The first player then makes his second move as shown, thus completing the three-moves. The second player now plays at will. This system produces such a tremendous variety of openings that mastery is impossible, although many

masters have extensive knowledge of perhaps the first ten moves in each of these openings.

5) BRIDGE: Refers to certain endgame positions where White has Kingrow pieces on squares 32 and 30 and Black may have similar pieces on 1 and 3. For an opponent to crown a piece he must first establish a piece on square 23 (when playing Black) to later crown by 24-27 or 22-26. A bridge-head on 23 is often considered weak because it is subject to later attack from a White King.

Dr. Samuels on Checkers . . .

. . . "For some years I have devoted my spare time to the subject of machine learning and have concentrated on the development of learning procedures as applied to games. A game provides a convenient vehicle for such study as contrasted with a problem taken from life, since many of the complicatons of detail are removed. Checkers, rather than chess, was chosen because the simplicity of its rules permits greater emphasis to be placed on learning techniques. Regardless of the relative merits of the two games as intellectual pastimes, it is fair to state that checkers contains all the basic characteristics of an intellectual activity in which heuristic procedures and learning processes can play a major role and in which these processes can be evaluated. Some of these characteristics are:

"1)The activity must not be deterministic in the practical sense. There exists no known algorithm which will guarantee a win or a draw in checkers, and the complete exploration of every possible path through a checker game would involve perhaps 10^{40} choices of moves which, at 3 choices per millimicrosecond, would still take 10^{21} centuries to consider.

"2) A definite goal must exist — the winning of the game — and at least one criterion or intermedite goal must exist which has a bearing on the achievement of the final goal and for which the sign should be known. In checkers the goal is to deprive the opponent of the possibility of moving, and the dominant criterion is the number of pieces of each color on the board.

"3) The rules of the activity must be definite and they should be known. Games satisfy this requirement. Unfortunately, many problems of economic importance do not. In principle, the determination of the rules can be a part of the learning process.

"4) There should be a background of knowledge concerning the activity against which the learning progress can be tested.

"5) The activity should be one that is familiar to a substantial number of people so that the behavior of the program can be made understandable to them. The ability to have the program play against human opponents (or antagonists) adds spice to the study and, incidentally, provides a convincing demonstration for those who do not believe that machines can learn!

"Having settled on the game of checkers for our learning studies, we must, of course, first program the computer to play legal checkers; that is, we must express the rules of the game in machine language and we must arrange for the mechanics of accepting an opponent's moves, together with all pertinent data desired by the experimenter."

(From STUDIES IN MACHINE LEARNING USING THE GAME OF CHECKERS by Dr. A.L. Samuel, from the IBM Journal of Research and Development, Vol. 3, No. 3, July 1959. Reprinted with permission.)

Correction

. . . A note from Dr. I.J. Good, of Virginia Polytechnic Institute and State University, corrects an error that appeared in an item in this department: "Burke Grandjean," he writes "points out in the January issue that a safe upper bound to the number of possible checkers positions is 5^{32}, not 4^{32} as printed in the editorial paraphrase in PERSONAL COMPUTING (December) of my article in MACHINE INTELLIGENCE II (1968). The expression in my article was '5^{32} or 3^{32}' (depending, of course, on whether Kings are taken into account) and PERSONAL COMPUTING's intention in replacing this by 4^{32} was presumably to save space. When Grandjean's letter was paraphrased, you must have overlooked that the figure 4^{32} did not occur in my original article. Combinatorial mathematics is one of my specialties and I hope that people who count my mistakes don't include this among them." The actual statement, attributed to Dr. Good, was extracted from a paper he wrote entitled "A Five Year Plan for Automatic Chess." It appeared in the English publication "Machine Intelligence II" (edited by Dale and Michie, Oliver and Boyd) and is dated January 1968. The statement says: "To make a rough comparison of possible chess positions with that of checkers positions, the very crude upper bounds, 13^{64} and 5^{32} or 3^{32}, suggest that the former is about the cube or fourth power of the latter."

PAASLOW Accept $5,000 Challenge

. . . Duke University's checker-playing program, PAASLOW, has picked up the gauntlet flung down at its feet by the American Checker Federation. "We are going to accept Marion Tinsley's challenge to play him," writes Tom Truscott, of Duke University's Computer Science Department. Tom is one of the two programmers of PAASLOW; the other is Eric Jensen, who wrote the original checker program in 1975. The current Duke program has competed against human players before. In 1977 it met Elbert Lowder one of the world's top-ranked checker players and won one game against him, lost two and drew two others. Against Tim Laverty, 75th strongest player in the United States, the Duke program scored two wins, one loss and one draw. How it will fare against Dr. Tinsley, rated, in the checker world, at the same level that Bobby Fischer has attained in chess, will be watched closely by millions of checker players in the country. "We are now going to try to get an Amdahl or an IBM 3033 to give us a better chance against Dr. Tinsley," says Tom. "Currently we are running on an IBM 370/165. However, even with a bigger computer, I still would not be overly optimistic for machine-kind. If any reader has such a machine (preferably running TSO) please let me know." As details of the match develop, announcements will be forthcoming from the American Checker Federation. This match, when it finally takes place, will be observed with great interest by both chess and checker players because it will be analagous to

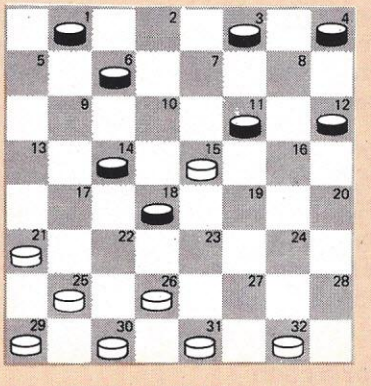
Bobby Fischer (best U.S. chess player) playing against CHESS 4.7 (considered to be one of the best U.S. computer-chess programs). We may never see Fischer test CHESS 4.7; but the chances are good that we will be seeing Tinsley against PAASLOW. The PAASLOW checker program was used by Tom Truscott as a guide in rewriting the DUCHESS chess program which went to Jerusalem in the summer of '78 and defeated CHESS 4.6 in a tournament there. PAASLOW must be considered the strongest non-human checker player in the world.

Video Brain vs CC-10

. . . Dick Fortman has evaluated the Video-Brain whose checker games is based on Dr. Samuel's original computer-program at IBM. "I have returned the machine to the Video-Brain company after a 30-day trial period," writes Dick. "Due to the fact that the cartridge was programmed by Dr. Samuel I suppose I expected too much. I personally played a dozen or more games against it at the highest level (fourth) and it gave me little or no resistance. I then arranged six games against Checker Challenger. One of the better games to emerge follows below. The Checker Challenger won four games against Video-Brain with two probable draws. I would certainly recommend the Video-Brain unit to anyone unacquainted with the game of checkers — as a source of enjoyment — but not to any player with an average degree of skill. Even the Checker Challenger has difficulty in this respect, but its added features — such as programming positions into it and problem solving make it worthwhile. I am not aware if Video-Brain (Umtech, Inc.) is interested in upgrading its cartridge. If so, I would be willing to assist in improving opening-procedures. I am presently conducting two six-game matches of computer versus computer (C.C. against itself) and I will send these along in the future." Some added carrots offered by Video-Brain, which uses the TV as display tube, is its large library of more than 20 cartridges that play games and run various, small programs. Also, and of great interest, is the announcement that Video-Brain is about to market a programmable cartridge that will permit the owner to use the machine as a small inexpensive microcomputer.

(Black moves first)

1.	11-15	23-18 (A)
2.	8-11 (B)	27-23
3.	9-14 (C)	18-9
4.	5-14	22-17 (D)
5.	15-18 (E)	23-19
6.	10-15? (F)	17-10
7	7-14	19-10
8.	6-15	24-19 (G)
9.	15-24	28-19
10.	2-6 (H)	19-15 (I)
11.	6-10 (J)	15-6
12.	1-10	25-22(K)
13.	18-25	29-22
14.	11-15	22-17



15.	4-8	17-13
16.	8-11	13-9
17.	3-8	9-5
18.	12-16	5-1
19.	16-20	1-6
20.	8-12	31-27 (L)
21.	11-16	6-9
22.	15-19 (M)	9-18
23.	19-24	27-23
24.	24-27	23-19
25.	16-23	26-19
26.	27-31	21-17
	White Wins	

Black — VIDEO- BRAIN vs.
White — CHECKER CHALLENGER (Level 4)

Annotations (By R.L. Fortman)

A) Titled the "Cross" opening — White's initial move crossing Blacks.

B) Or 9-14 now; the "Cross-Choice", but 8-11 retains the Black opening edge.

C) Now a poor response, as White can break the opponent's double corner side. Instead, the three options in 4-8, 10-14, or 9-13 hold the advantage.

D) White relents. Here 22-18, 15-22, 25-9, 6-13, and 23-18 is strong, with center control.

E) 4-8, 23-19 transposes into a standard variation of this opening, then 15-18 is in order; continued with 26-22, 11-15, (not 11-16, 22-15, 16-23, 31-27, 10-19, 17-10, 6-15, 27-4-a WW, and the type of shot or stroke the 'Checker Challenger' "sees". . .) 17-13, 7-11, 22-17, 2-7 (here 11-16 is another fatal mistake after 31-27, 16-23, and 25-22 etc. WW) 32-27, *1-5 & 24-20 etc. to a draw.

F) A position mistake, which removes the supporting back pieces, but the serious consequences are not apparent to the present level of computers. A human player of just average skill would not make a move of this nature. Instead, 4-8 is correct, and into Note E. . .

G) An excellent reply, with the proper 28-19 sequel, and the center thrust.

H) If the more natural 4-8, White is still in command with 19-15, and the later press with 26-22 to win.

I) The powerful follow-up — See diagram.

J) Disrupts the Black right side, allowing a free White king. However, 4-8 is Note H and also bad after 26-22 etc. All of this caused by the rash double exchange at Note F.

K) 26-22 also wins. The ending is now hopeless, but continued to illustrate the finishing tactics of the Fidelity computer.

L) Preparing for the king press at next move.

M) Resignation is now in order.

Personal Computing... It All Comes Together at NCC '79.

Only during the National Computer Conference will you have an opportunity to experience personal computing to the fullest. And that's why the 1979 Personal Computing Festival, June 4-7 in New York's Sheraton Center Hotel, formerly the Americana, is different. As a conference within a conference, it will give you the chance to explore the complete spectrum of information processing while concentrating on those aspects of personal computing you won't want to miss...including equipment, applications, ideas, and new developments that have created excitement throughout the entire computing community.

Only at NCC '79 will you find such a panorama of computer products on display...ranging from micros to maxis, from processors to peripherals. Included will be the latest innovations in low-cost computing for business, professional, and home use.

Against the backdrop of the prestigious NCC, the Personal Computing Festival has attracted many well-known experts and personalities who will participate in an information-packed technical program and compete for prizes for the best presentations. Join them in exploring applications ranging from use of small business systems and financial analysis to personal networking, new information utilities, and aid to the handicapped.

You will also have ample opportunity to discuss new ideas and novel approaches to shared problems, to find out what to expect in the year ahead, and observe interesting and clever applications demonstrated by the individuals who developed them.

Plan now to take part in a unique personal computing experience at NCC '79. You can register for the Festival at the Sheraton Center Hotel, 52nd Street between 7th Avenue and Avenue of the Americas, for only $15 which includes your copy of the **NCC '79 Personal Computing Proceedings.** Registrations, excluding the **Proceedings,** also are available at $5 for one day and $9 for all four days. The **Proceedings** will be available separately at $8. For additional information on NCC '79, including housing and registration procedures, contact AFIPS, 210 Summit Avenue, Montvale, N.J. 07645; telephone 201/391-9810. To obtain information on the special NCC Travel Service call toll-free 800/556-6882.

NCC '79
PERSONAL COMPUTING FESTIVAL
c/o AFIPS, 210 Summit Avenue, Montvale, N.J. 07645

Pocket Calculator Guide

How to Use a Pocket Calculator: A Guide for Students and Teachers by Henry Mullish; Arco Publishing Co., 219 Park Avenue South, New York, NY 10003; © 1977; 191 pp., illus., $8.95; paper $4.95.

This book does what its title says it does: shows you how to use a pocket calculator.

The author, Henry Mullish, who is listed as having written the first book on calculators, has produced numerous texts on computer programming and programmable calculators. He maintains that a world revolution is now taking place in which the only sound of the struggle is the millions of clickings of keys of electronic pocket calculators. With their LSI's and their silicon chips, the calculators are closely related to the computers and like the computers themselves, the numbers of different styles and models of calculators on the market have reached staggering proportions.

Mullish raises the question of the value of calculators in human development. Is there too much of a growing dependence on computers? he asks. "There are those who believe that students should be forced to calculate everything with pencil and paper. Otherwise, they fear, the brain will atrophy. In the distant future a group of scientists will gather around the remains of a 20th century man and wonder what possible function the brain must have served in the past." Henry counsels the modern generation to use the calculator only when there is a real need for it, and thereby gain maximum advantage. "With the aid of the pocket calculator," he says, "lengthy calculations which might otherwise be quite tedious and burdensome can be handled quickly and precisely. In many cases the chore may even be fun." So, having admonished the readers not to ride when they can walk, the author goes on to explain the use of the calculator to ease mathematical drudgery.

The book wastes no time in dallying but starts off immediately with some problems and demonstrates the techniques in solving them by calculator. For example, a "back-to-school" sale offers notebooks reduced 15%. "If the regular price of a set of notebooks was $8.75, how much is the sale price?" Mullish's neat little book shows how to solve this and similar problems with the following routine, repeated throughout the text:

"Sequence No. 1" (first thing to do): "Key In" (type out) the figures 8.75. The "Display" (or "X" register) now lights up with the figures 8.75. So much for "Sequence #1". On to "Sequence #2". "Key in" the percentage symbol (%). The figure 8.75 remains in "display," ("X" register) but is also shifted to the internal "Y" register. On to "Sequence #3". "Key in" 15. The "X" register now "Displays" the figure 15. In "Sequence #4", the % symbol is "Keyed in" and the 15 goes to join the 8.75 in the "Y" register where it performs the mathematical function of taking 15% of 8.75 producing a result of 1.3125. Now in "Sequence #5", the subtract symbol (−) is "Keyed in" and the "X" register "Displays" what went on in the "Y" register: 1.3125 was subtracted from 8.75 leaving 7.4375 which is the sale price of the notebook. Voila! The problem is finis!

Mullish uses a tabulated shorthand to show the functions taking place:

S (Seq.#)	1	2	3	4	5
K (Key in)	8.75	x	15	%	
D (Display)	8.75	8.75	15	1.3125	7.4375

A	S	1		2		3	4
	K	1.06		X		=	X
	D	1.06		1.06		1.1236	1.1236
	S	5		6		7	8
	K	=		X		=	X
	D	1.2624769		1.2624769		1.5938479	1.5938479
	S	9		10			
	K	3500		=			
	D	3500		5578.4676			
B	S	1	2	3	4	5	6
	K	1.06	ENT↑	8	*yx*	3500	X
	D	1.06	1.06	8	1.593847	3500	5578.4645
C	S	1	2	3	4	5	6
	K	1.06	*yx*	8	X	3500	=
	D	1.06	1.06	8	1.593848075	3500	5578.468261

TABLE 1

The book goes on to show how problems, in general are solved using any of the three popular types of calculators:

A — Basic calculator. The four-function "four-banger" machine.

B — Intermediate calculator.

C — Advanced calculator.

Bulk of the problems in the book can be solved with the inexpensive A calculator, says the author. Expensive calculators will solve the problems more elegantly — with fewer steps and with greater accuracy. A nice assortment of exercises are included in the book and answers to these exercises are printed in an appendix.

To illustrate the use of the calculator in solving practical problems, the author includes this one; and shows how each of the three calculator-types solves it.

"Determine the amount of money that will result from investing $35,000 in an account for 8 years, if interest is compounded annually at the rate of 6%."

(Not only are investment problems important in themselves, says the author, but they prove to be fascinating to a great number of businessmen. Furthermore, they have direct applicability to problems of everyday life.)

To compute the amount of money in the above problem that will result from an investment of P dollars, at the an-

nual investment rate of $r\%$, for a period of n years, we use the compound interest formula: (See Table 1)

$$\text{amount} = P(1+r)^n$$
$$\text{where } P = 3500,\ r = 6\% = .06,$$
$$\text{and } n = 8$$
$$\text{amount} = 3500\,(1 + .06)^8$$
$$= 3500\,(1.06)^8$$

The compounded amount therefore equals $5578.47. On the basic calculator, A, 1.06^8 was calculated as $(((1.06)^2)^2)^2$, advantage being taken of the constant feature.

Table 1 illustrates the differences in the three calculator types. The problem is done in 10 steps in the A calculator; in six steps in the B calculator; and in six steps, also, in the C (most expensive) calculator. However, the C calculator offers the most accurate solution.

If, you'd like to start working out on your programmable calculator, this handy little book is a good beginning.

Reviewed by Harry Shershow

Microcomputer Board Data Manual, by Dave Bursky; 128 pp.; $7.95 paper. *Programming Programmable Calculators,* by Harold S. Englesohn; 224 pp.; $9.95 paper. *Computers in Action,* by Donald D. Spencer; 184 pp.; $5.95 paper. *The First Book of Microcomputers,* by Robert Moody; 144 pp.; $4.95 paper. *Fundamentals and Applications of Digital Logic Circuits,* by Sol Libes, 208 pp.; $7.95 paper. All available from Hayden Book Company, 50 Essex St., Rochelle Park, NJ 07662; (201) 843-0550.

The first of these five personal computing books from Hayden, *Microcomputer Board Data Manual,* is a reference covering various microcomputer boards available from more than 30 manufacturers. The book features a one-page data summary for each board or family of boards and information on support products and software.

Programming Programmable Calculators, a jargon-free introduction to PPCs, covers SR52, SR56, TI57, TI58 and TI59 from TI, the Commodore PR-100 and the APF programmable model.

Hayden's third book, *Computers in Action: How Computers Work,* serves as a general introduction to computers — what computers are, how they work, what they can do. This second edition includes information on microcomputers, floppy disks, new input/output units and structured programming.

Robert Moody's book, *The First Book of Microcomputers: The Home Computer Owner's Best Friend,* is another introduction to computing. The book explains what personal computers are and what they can do. Other topics covered include computer languages and home and business applications.

The second edition of Sol Libes' *Fundamentals and Applications of Digital Logic Circuits* contains updated information on recent uses of digital logic, including information on microprocessors and microcomputer systems. Topics covered include basic theory and circuit designs, the circuitry of calculators, digital voltmeters, frequency counters and computers.

All About Small Business Computers, Datapro Research Corp., 1805 Underwood Blvd., Delran, NJ 08075; $12.

This report provides hardware and software characteristics of the small business computer systems currently being marketed in the United States. The 70-page report describes the capabilities and limitations of today's small business computer systems and provides guidance in selecting the most suitable equipment for specific applications. Featured are 58 pages of comparison charts covering 289 systems from 84 suppliers of small business computers, as well as user ratings, buying hints and discussions of new technologies.

The user ratings summarize the experience of over 800 users representing more than 2300 installed small business computers and minicomputers. Extensive tables show how these users assessed the strengths and weaknesses of all the popular systems and their vendors.

For each of the 289 systems listed, the report provides specifications on the formats used to store and process data; the central processing unit; in/out capability; internal storage and mass storage facilities; keyboard facilities; compatible input/output devices; communications capabilities; software support and prices; and system pricing and availability.

WHAT'S COMING UP

SYSTEMS

New Z-80 Microsystem from Vector Graphic

A new microcomputer system, designed for small businesses and in-house data processing departments, has been introduced by Vector Graphic Inc. System B is configured around the Z-80 based Vector MZ microcomputer and 12" diagonal Mindless Terminal. It features their Flashwriter II video board displaying 80 characters x 24 lines with an 8 x 10 character matrix. The new business system also incorporates the company's 48K Dynamic RAM board.

System B system software includes MDOS with Micropolis BASIC and Vector Graphic's MZOS disk operating system as well as CP/M. A Z-80 assembler, ZSM, is also provided to facilitate interactive program customization.

The Vector Graphic System B, with a suggested retail

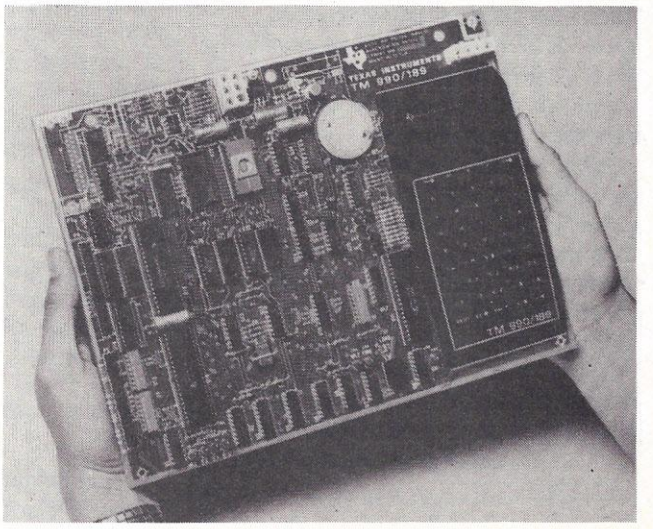
price of $4750, is available from Vector Graphic dealers. For further information contact Vector Graphic Inc., 31364 Via Colinas, Westlake Village, CA 91361/ (213) 991-2302.
Circle No. 152

Single Board Microcomputer System from TI

A new self-contained, single-board microcomputer system from Texas Instruments, designated the TM990/189M, is designed as a low-cost, completely assembled learning aid for hands-on experience plus instruction in microcomputer fundamentals, assembly and machine language and microcomputer interfacing.

The system comes with a user's guide and a detailed applications textbook. The microcomputer board is punched for insertion into a three-ring binder. The board is self-contained with 1K bytes of RAM (expandable on board to 2K) and 4K bytes ROM (expandable on board to 6K). The 4K of ROM contains the system monitor and a symbolic assembler. Mass memory storage can be accomplished via the audio cassette inteface.

Built into the TM990/189M is a 45-key alphanumeric keyboard and a 10-digit, seven segment display. The display



has a 32 character buffer which may be shifted right or left to view any 10 digits of the 32 character buffer. Provisions are on the board to externally add a standard EIA terminal or TTY interface.

Other features include a series of addressable LEDs and a piezoelectric speaker for audio signals. When the microcomputer is powered up, a group of four LEDs flash, the piezoelectric speaker beeps and the display signals, "CPU READY". Powering up the microcomputer not only clears the system, but also serves for self-diagnosis. In addition, other LEDs signal the status of the audio cassette, when the CPU is in Idle, and when the keyboard is in the "shifted mode". Price is $299. For more information contact Texas Instruments Inc., Inquiry Answering Sevice, P.O. Box 1443 M/S 653, (Attn: TM990/189), Houston, TX 77001.
Circle No. 153

Micro-12 CMOS System from Harris

The new Micro-12 single-board microcomputer system from Harris Semiconductor Division features an HM-6100 CPU, ROM and RAM memory, UART and parallel I/O port, making it capable of directly interfacing with a teletype, CRT terminal or tape cassette.

The Micro-12 System accepts PDP-8 object code inputs as long as they contain no unusual I/O requirements. A programming manual supplied with each unit also gives instructions for programming the system from an on-board key pad.

The fully-assembled and tested 12-bit CMOS system permits use of the extensive PDP-8 software library, including manuals, data books and application notes, and is particularly useful for industrial control and data acquisition applications, the company said.

The CPU — a Harris HM-6100 CMOS processor — features single-address, fixed 12-bit word length and parallel

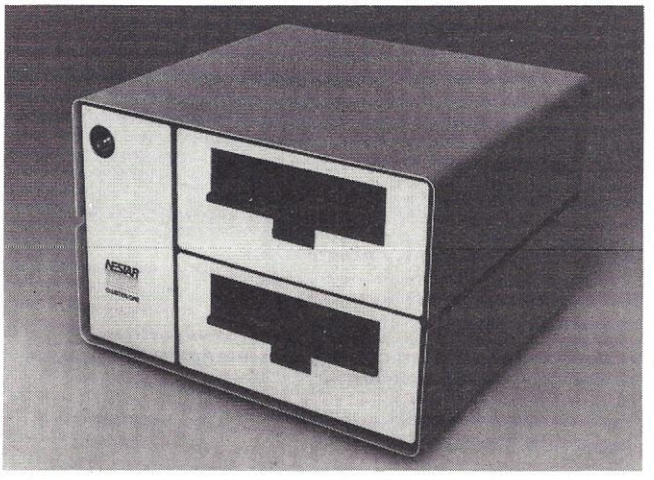
transfer. Support is presented by a wide supplement of CMOS devices that are all Harris built — including RAMs, ROMs and PROMs. The system also has a peripheral interface element (PIE), a universal asynchronous receiver transmitter (UART) and a bit-rate generator.

For program debug, the Micro-12 System has a monitor with four independent brakepoints. Program memory includes a 256 x 12 RAM with space provided for expansion to 1K x 12.

Harris Micro-12 Systems cost $550 each. Contact Harris Semiconductor Corp., P.O.Box 883, Melbourne, FL 32901. *Circle No. 154*

Distributed Processing for Micros

Nestar Systems introduced Cluster/One, a low cost distributed processing alternative to BASIC timesharing. The central Cluster/One unit (the Queen) connects to up to 15 personal microcomputers (the Drones) via a high-speed parallel data bus (the ClusterBus). An optional feature provides support for an additional 15 Drones. Currently supported as Drone stations are the Apple II and the Commodore PET 2001-8. Radio Shack TRS-80 support will be available soon.



Cluster/One permits each BASIC user to have his own computer, rather than a small share of one central processor. Thus, even real-time graphic applications or simulations become feasible.

Programs and data files can be shared among users. They are stored on two IBM-compatible eight-inch flexible diskettes. Each diskette holds up to 315 thousand bytes of data, sufficient for about 100 programs. Disk transfer rates are 250 thousand bits per second, managed via an LSI floppy-disk controller chip. All data transfer are CRC-checked, and disk writes are automatically verified. Data is transmitted to each Drone station in packets, with their own CRC checking. System response time for program loading is typically two seconds.

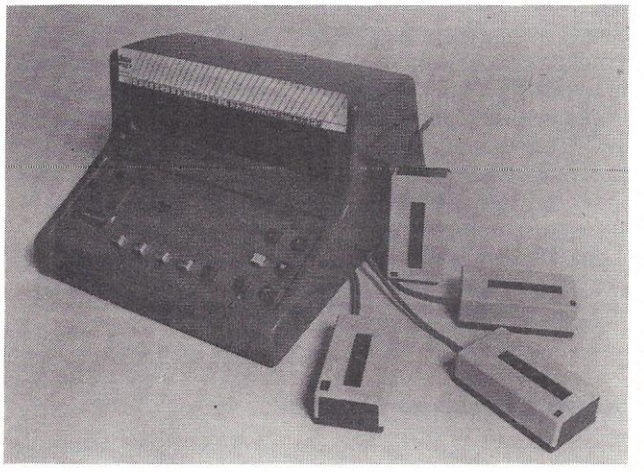
Cluster/One comes with utility programs for system maintenance and backup,along with separate documentation for end users.

Prices begin at $4500 and vary with the particular configuration and option selected. For further information, contact Nestar Systems, Inc., 810 Garland Drive, Palo Alto, CA 94303; (415) 327-0125. *Circle No. 155*

Electronic Education System Prints Grades and Averages

DISPA is an electronic education system which shows the teacher test answers from each pupil, and prints out each score as well as the average class score.

For elementary, secondary and college levels, DISPA consists of a central operating unit, with or without a microcomputer and printer for the teacher, and room for a maximum of 32 answer boxes for students. As the answers are projected on a screen, the instructor can determine which points require further stress and concentration.



Also, the microcomputer processes and stores the answers. Thus, answers are recorded for school officials to judge what progress has been achieved. The system's grading function relieves the teacher from marking papers and allows the class to go on to other work.

Each plastic answering box has four alternative keys and a reset key for correction. After the teacher inputs the correct answer, the right and wrong answers from pupils appear on the screen as green and red lights, respectively. All boxes are impact-resistant and their safety is insured by the low-operating voltage. Only the central unit requires 220 volts.

DISPA is a product of Oostendorp. B.V. of Zwijdrecht, the Netherlands. For additinal details write to the Netherlands Consulate General, Commercial Division 684, One Rockefeller Plaza, New York, NY 10020. *Circle No. 156*

Micro-Slice Single Board Communications Computer

Micro-Slice, from Micro Diversions, is a complete Z-80A-based communications computer on a single S-100 Board for business and hobbyist applications. It offers a 4 MHz Z-80 module, with power-on jump to any 256 byte boundary, eight software prioritized interrupt inputs and a real-time clock; up to 8K of ROM, dip switch mappable to any 4K/8K boundary; and 2K static RAM (2114), dip switch mappable with the ROM to any 4K boundary.

The Micro-Slice has an asynchronous/synchronous serial port with 16 software-selectable baud rates (50-19.2K), software selectable parity, stop bits and number of data bits, break detection and generation, local or remote maintenance loopback, automatic SYN or SYN-DLE insertion, SYN or

DLE stripping, transparent or non-transparent mode, X.25 or X.75 level one compatability, full or half duplex operation, jumper selectable interrupt generation on character-received, character-transmitted, all data set signals sampleable, dip switch mappable as the 3rd and 4th ports of any 4-port boundary.'

Also included are two fully buffered bi-directional parallel ports, common output buffer and dip switch mappable as the first and second ports of any 4-port boundary. Each bit of the second input port is independently selectable as an interrupt line to the CPU's interrupt logic. A slave mode operation permits multiple Micro-Slices to run on the same bus under one CPU. Front panel software has examine, deposit, call, input, output, jump, block transfer and search commands; and USART initialization supplied as either listing or pre-programmed on EPROM.

Unit price is $349 per kit, $395 assembled and tested. For more information contact Micro Diversions, Inc., 8455-D Tyco Rd., Vienna, VA 22180; *Circle No. 185*

Sord Small Business Computer

Sord U.S.A., Inc., has introduced the M223 Model from its M100 series of small business computers.

Features include a standard 93-key ASCII keyboard with 10-key numeric pad and 16 BASIC statements keys. Included are upper/lower case, repeat key and full cursor control.

The 12" CRT displays 1920 characters in a 5 x 7 dot matrix. Full ASCII along with 64 graphic characters are seen on the screen as green characters on a dark background. Reverse video by character and cursor blinking are standard.

The system contains 4 S-100 bus slots. Available options include Analog I/O, Digital I/O, Bar code reader/printer, OCR reader, Centronics parallel interface and IEEE 488 bus interface. Among Sord's software is an advanced diskette operating system, FORTRAN, COBOL, Extended BASIC PLUS and full graphics.

For more information contact Sord U.S.A., Inc., International Trade Center, 8300 NE Underground Drive, Kansas City, MO 64161; (816) 454-6300. *Circle No. 197*

Computer Training Systems

Group Communications Systems, Inc., has introduced a new line of electronic training systems called Responda-Tronic. Both RespondaTronic training systems, Mark I and Mark II, provide two way communication between instructor and student.

Mark I, or Student Response System,can be installed in rooms with 10 to 100 students. The Mark II, or Auditorium Response System, can be installed for mass training capability in auditoriums with a seating capacity of more than 2000.

Mark I and Mark II have a main console that controls all the systems' functions from one location. The Mark I has a three button response system and an LED indicator that displays student answers. It also provides digital readouts that calculate the totals and percent of the different student responses to test questions.

With the Mark II, a separate central processing, printing, polling, storage and student transmitter system is controlled from a master console located at the instructor's lectern.

The central system of the Mark II consists of a microprocessor equipped with a high speed floppy disk operational system which centrally controls all functions.

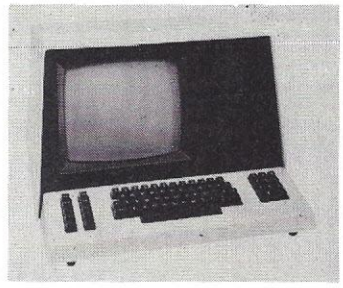
Mark II also has a CRT printer and large digital readouts. Solid state circuits provide the interface between the computer and the student stations, floppy disk storage devices and other components of the system. The floppy disk system transfers any data onto magnetic disks for storage. When the stored data is to be printed, the desired disk is run through the reader and then is automatically fed to the line printer.

The system can retrieve a 30-day question history that has been stored on individual students, flash it on a CRT or list it on the line printer. Hardware modifications for self test capability at the response stations are also available.

Instead of an individual wire from each response station to the lectern, the system utilizes one ribbon wire looping all response stations together to the master control of the lectern.

For further information contact Group Communication Systems, Inc., 1801 Century Park East, Los Angeles, CA 90067; (213) 556-2447. *Circle No. 186*

Small Business Computer from Scientific Data



A new small business microcomputer system has been announced by Scientific Data Systems, Inc. Designed for professional use, the SDS 420 system is self-contained in a small desk-top cabinet. All subsystems are modular for simple servicing.

The system includes a 2 MHz 6502A microprocessor. Instruction times are 1 microsecond minimum and 3.5 microseconds maximum Its 32K bytes of memory with 250 nanosecond cycle time is expandable to 56K and contained on a single PC board.

From 1-1/2 to 10 Megabytes of floppy-disk storage is included on the high speed PerSci dual-diskette, single/double density drives. Dual head drives are optional and up to four drives can be supported by the system.

A high resolution Ball Brothers 12-inch CRT display with 25 lines of 80 characters per line and an independent 2K byte refresh memory is also included.

The SDS has a 71-key alphanumeric detachable keyboard with decimal pad, cursor control, reset and interrupt keys and three user-programmable keys.

The SDS 420 employs an extended 12K BASIC interpreter which provides all the features of standard BASIC plus commands for formatted printing; the input of strings with embedded terminators; extensive string manipulative commands; file interface to random, sequential or keyed files with indexed sequential access; I/O device handling; error handling; extensive screen window management; and source file editing. The keyed file interface makes it possible to write data manipulation programs in BASIC with minimum commands.

Single unit price is $7700. For more information contact

Scientific Data Systems, Inc., 12640 Beatrice St., Los Angeles, CA 90066; (213) 390-8673. *Circle No. 187*

NCR Data Processing System

NCR Corporation has announced a new minicomputer system designed to handle the information processing needs of specialty stores and small department stores.

According to NCR, the new Retail Management System provides sophisticated data processing capabilities for stores in the $2 million to $10 million annual volume range. The system includes four software modules or applications and uses point-of-sale terminals (such as the NCR 250 and NCR 2140), visual display terminals and an NCR I-8200 Series minicomputer. As purchases are made, all sales and merchandise information is recorded on a magnetic tape cassette, which is subsequently processed by the in-store minicomputer. All other data is entered using the visual display terminal. Store managers can also use the terminals to retrieve specific information or to request reports.

Applications include sales analysis and inventory, accounts receivable, merchandise account payable and general ledger.

The system can be used by single or multiple store operations and offers managers a variety of accounting options. For example, it can operate using department level, class level or SKU (Stock Keeping Unit) inventory level information. The system can accommodate either the retail method or direct cost method of inventory evaluation.

Reports provided by the system include sales audit, sales analysis, unit inventory, cash requirements, credit exception and comparative financial statements.

A basic computer configuration used with the Retail Management System includes an NCR I-8230 processor with 80K bytes of main memory, 10 million bytes of disk capacity, a visual display terminal and a line printer. The basic configuration rents for approximately $1300 a month under a five-year agreement and sells for $38,000.

The purchse price for all four application modules of the system is $7500. Purchased individually, the general ledger application costs $1500 and the remaining three modules are $2000 each. The accounts receivable application requires the use of the sales analysis and inventory module. Accounts payable and general ledger programs may be used individually.

For more information contact NCR, Dayton, OH 45479; (513) 449-2150. *Circle No. 188*

Billable Time Recording System

Wespac offers a billable time recording system for lawyers and other professionals who offer services on an hourly fee basis. About the size of a telephone, the ITR-700 sits on your desk. By punching appropriate keys, you log in each of your daily activities and the account they should be billed to. Special interrupt keys allow you to log in telephone calls and other billable or non-billable interruptions. At the end of the day, the unit prints out summaries of your billable time and charges. Information recorded includes operator's name, clients's name, date, time of day and billing rate.

Contact Wespac Electronic Instruments, 2445 Chico Ave., South El Monte, CA 91733. *Circle No. 189*

PERIPHERALS

Princeton Electronic Products' Computer Graphic Terminal

Princeton Electronic Products, Inc., introduced its 8500M Intelligent Graphics Terminal, which uses beam addressed solid-state image memory. The Lithicon solid-state addressed image memory plane contains over four million micro-capacitor elements providing high resolution performance, the company said.

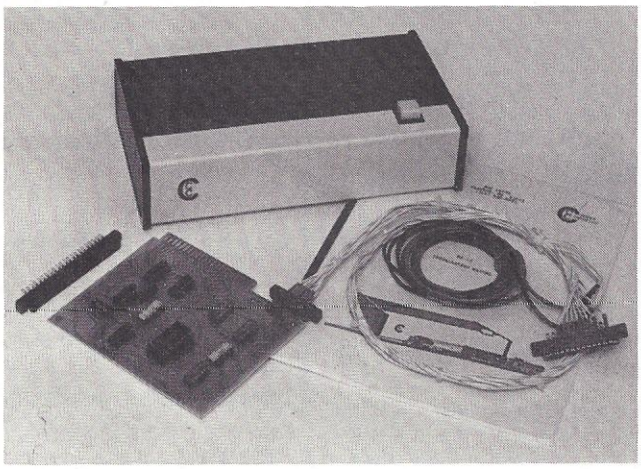
The terminal offers smooth, continuous, high resolution raster graphics without stairstepping. It uses a 4096 by 3072 viewable window and has an addressable field of 8192 by 8192 points.

Additional features include 16× panoramic zoom and preview window for selective magnification; microprocessor minimization of burden on host computer; stroke written alphanumerics, symbols, conics and vectors; expandable RAM for user designed characters and symbols; and selective erase of graphics and alphanumerics.

Options include floppy disk, MT cassette, digitizer, APL keyboard, additional image memories, high speed gray scale interfacing and additional character RAM. For more information contact Princeton Electronic Products, P.O. Box 101, North Brunswick, NJ 08902; (201) 297-4448. *Circle No. 190*

Control System for TRS-80 and PET

Able to sense up to 24 inputs and drive 16 medium power outputs, the SY-16 is a plug compatible control system for



TRS-80 and PET with all software and hardware furnished; the purchaser removes it from the shipping carton, plugs it into the computer, enters the program and starts operation.

The 16 output devices can be any 6 volt or less on/off mechanism using less than 1/4 Ampere. For example, lamps, LEDs, solenoids, stepping switches and DC motors are typical applications. Relay coils can be driven directly. By selecting a 6 volt relay with appropriate contacts, AC signals and power can be switched, controlling most equipment originally designed for manual operation.

Input devices can be TTL gates or any form of switch contacts, including thermostats, reed switches, microswitches, joysticks, keyswitches and numeric keypad. The SY-16 can sense for open or closed condition. Up to eight switches can be wired for very fast operation; a switch closure can be "captured" and held, or noisy contacts can be debounced.

A software timing and control program (STAC) lets the user specify and execute complex timing, sensing and control sequences without having to program, or allows writing programs which call STAC as a subroutine. An interactive program is also furnished to help design sequences and experiment with them.

The SY-16 comes completely assembled, tested and ready to plug into TRS-80s (model T) or PETs (model P) with software and comprehensive instruction manual describing sequence design, I/O device control, STAC operation and example application. Price is $289. The instruction manual alone is available at $12, refundable upon SY-16 purchase within 60 days. Contact Cooper Computing, Box 16082, Clayton, MO 63105; (314) 889-6116. *Circle No. 191*

CRT Copier Provides Hard Copy from Tektronix Terminals

Houston Instrument has designed the 8610 CRT Copier to provide low cost, high quality hard copy from the Tektronix 4010 family of terminals. This addition to the Complot 8600 Series gives hard copy output from the 4010, 4012, 4013, 4014-1 and 4015-1-terminals as well as the Tektronix 4006 terminal. The 8610 is also compatible with the Tektronix 4051 desktop graphics computer, the 613 storage display unit and the new Tektronix 4025 graphics terminal. The copiers utilize an electrostatic printing method that features a patented dual row of styli with overlapping dots for high contrast output. Electrostatic paper produces permanent non-fading copies. A finished copy of the display is completed in less than 20 seconds. The 8610A Copier provides copy from up to four terminals.

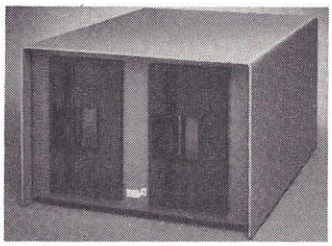
Price is $4495 to $4995. For more information contact Jim Raska, Houston Instrument, One Houston Square, Austin, TX 78753; (512) 837-2820. *Circle No. 192*

SLM's CRT Terminal

SLM Inc. offers the VT-4800 CRT Terminal. Features include IBM Selectric keyboard; 19 user-defined keys; optional character sets for German, Spanish and Russian; and optional low and high density vector graphics.

Price for the VT-4800 is $1395 in single quantities. For more information, contact Frank Hatch, V.P. Sales, SLM, Inc., 2366 Walsh Ave., Santa Clara, CA 95050; (408) 727-1030. *Circle No. 193*

Mini-Disk Systems from IMSAI



IMSAI now offers the MD-X Floppy Mini-Disk System, featuring 40- and 77-track, single/double density, 5-1/4-inch floppy disk drives.

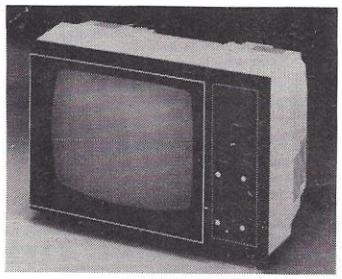
System configurations include IMSAI's DIO-D Controller, which will support up to four drives of the same model. The two versions, when fully implemented to include four drives, provide disk storage capacities of up to 800K and 1560K bytes, respectively.

MD-X systems feature IMDOS, IMSAI's Multi-Disk Operating System. On any IMSAI 8080 or 8085 based computer, IMDOS will simultaneously support mini-disk drives and standard 8-inch drives. On system with an IMSAI hard disk system, a version of IMDOS is included that will support mini and standard floppy disk drives as well as the hard disk.

All models of the MD-X Series utilize two mini-disk drives in a desk-top cabinet. The two basic units, Model MD-2 and Model MD-4, may be part of any IMDOS-compatible configuration. Models MD-2E and MD-4E are expansion units for the MD-2 and MD-4, as well as for IMSAI mini-disk based computers.

For more information contact IMSAI, 14860 Wicks Blvd., San Leandro, CA 94577; (415) 483-2093. *Circle No. 194*

Low-Cost Video Terminal



A new black and white, low-cost 12-inch video terminal for home, personal or business computer systems is now available from Micro Products Unlimited.

The lightweight (14.3 lbs. net, 6.5 Kg.) monitor is compatible with many computer systems, the company said. Features include composite video input, video bandwidth of 12 MHz + 3dB, 75 ohm input impedance, resolution of 650 lines minimum in central 80% of CRT and 550 lines minimum beyond central 80% of CRT. Dimensions are 11.375" high, 16.250" wide and 11.250" deep, excluding input connector.

The terminal lists for $139 plus $5 for handling and shipping (Texas residents add 5% state tax). Contact Micro Products Unlimited, P.O. Box 1525, Arlington, TX 76010; (214) 461-8043. *Circle No. 195*

Computalker TRS-80 Speech Synthesizer

Computalker Consultants announced the new Model CT-1T, a speech synthesizer for the Radio Shack TRS-80 microcomputer.

The Speech Synthesizer is a completely self-contained unit. It is packaged in a 6" high by 4" wide by 12" long

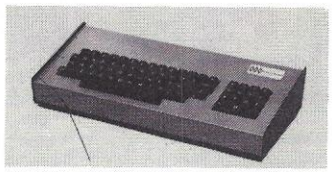
chassis and has its own 110 VAC power supply. The interface circuit board contains an on-board 2 watt audio amplifier, an S-100 connector for the CT-1 speech synthesizer board, and a Radio Shack compatible edge connector. An interconnect cable (supplied with the Model CT-1T) connects the unit to the TRS-80 bus connector on either keyboard or expansion interface. Standard phono jacks provide connections for external speakers, headphones or external amplifier (not provided).

The unit operates with Radio Shack TRS-80 microcomputers equipped with Level II BASIC and a minimum of 16K RAM memory (32K recommended). The synthesizer is controlled by nine acoustic-phonetic parameters transmitted on the microcomputer bus. These parameters control the perceptually and physiologically fundamental aspects of speech as determined by contemporary phonetic research.

The Model CT-1T can be operated in two modes (Direct Parameter Control and Phonetic) and is supported by a library of software. Each unit is shipped with a hardware user manual, basic set of software consisting of CTEDIT Parameter Data Editor and speech parameter data files HELLO, LETTERS and DIGITS, and the Computalker CSR1 Synthesizer-by-Rule Software program. All software is available in choice of 5-1/4 inch diskette or standard cassette.

Suggested retail price for the unit is $595 and includes interconnect cable, user manual and software. A special unit is available for persons who already own a Model CT-1 and is priced at $225. For more information contact Computalker Consultants, 1730 21st Street, Suite A, Santa Monica, CA 90404; (213) 392-5230. *Circle No. 157*

GRI Keyboard Subsystem



George Risk Industries has announced the Model 771 Keyboard Subsystem designed for personal, small business and educational microcomputer systems. The Model 771 keyboard includes 56 alphanumeric keys which provide the entire 128 character ASCII set, including lower case and a separate 15 key numeric/cursor control keypad.

The unit features four modes of encoding including upper case only with the alpha lock key. Four power supply options allow use with any available supply voltage source. A versatile interface permits user selection of data, strobe and parity sense for proper operation with almost any system. An optional adapter mounts within the 771 enclosure to convert the keyboard to a self-contained keyboard transmitter with 110 to 9600 baud RS-232 or current loop serial data output.

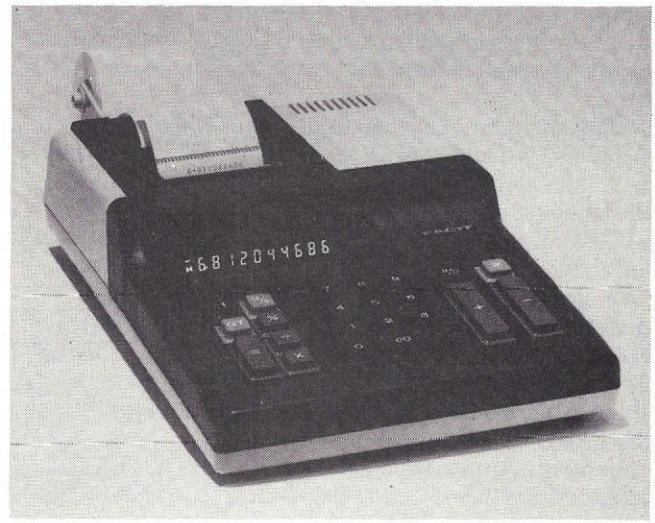
Standard features include auto-repeat, two-key rollover and fully buffered outputs. The 771 is equipped with a parallel interface and D series connector. Non-glare, two-shot molded keycaps are also provided. Fully assembled, tested and housed in a rugged all-steel desktop enclosure, the Model 771 is ready for immediate use.

The 771 is priced from $150. For further information, contact George Risk Industries, Inc., GRI Plaza, Kimball, NB 69145; (308) 235-4645. *Circle No. 158*

COMPLEMENTS

Facit-Addo Display Printing Calculator

Facit-Addo, Inc., has introduced the Facit 2252, a calculator with a 10-digit capacity in both print-out and display. The four-function calculator features a grand total register; decimal selection for add-mode; 0, 2, 3, 4 or floating decimal; a round-off selector and an item counter.



The 2252 has single and double zero keys, a percentage key and the ability to perform repeat addition and subtraction. Other features include a buffered keyboard, a switch for constant operation and operation with or without print-out.

For more information contact Facit-Addo, Inc., 66 Field Point Rd., Greenwich, CT 06830. *Circle No. 159*

Data Work Station Furniture

Smith System offers CRT work stations. Top sizes range from 24" x 30" to 30" x 60". Work stations are available with modesty panels and storage shelves. Chrome or enamel

T-Bar legs come in working height or standing height. Smith System also has other computer support furniture including files and various tape storage systems.

For further information contact Smith System Manufac-

turing Co., P.O. Box 43515, St. Paul, MN 55164; (612) 636-3560. *Circle No. 160*

Dust Covers for Computers

Cover Craft recently announced a new line of protective dust covers to fit all popular brands of computers and peripherals.

According to the company, hundreds of sizes are available, each designed to fit a specific model. Each cover is custom designed, then hand cut from textured flexible vinyl. All seams and edges are machine stitched for strength.

Covers for popular models manufactured within the last two years will shortly be available at retailers across the country, the company said. Older or less popular models may be ordered direct from the factory.

For further information contact David Mackey, Cover Craft, P.O. Box 555, Amherst, NH 03031; (603) 673-8592. *Circle No. 161*

Edmund Offers Two Sound/Off Power Monitors

A Sound/Off Power Monitor, an electronic alarm device, is being offered by Edmund Scientific. Designed to monitor the voltage to any electrical equipment or appliance, it is suitable for use in computer rooms and industrial and medical labs. If power fails or drops, or if equipment is disconnected, the monitor sounds a loud alarm that pulses twice per second for up to three days. After the power has been restored, the alarm will stop automatically.

The Power Monitor has been designed for 115 AC equipment and requires 10 watts. A built-in relay trips if power drops below present voltage. Adjustable from 90 to 117 V, it also monitors refrigeration and heating equipment. The alarm operates on a 9V transistor battery with a solid-state conservation circuit for longer life.

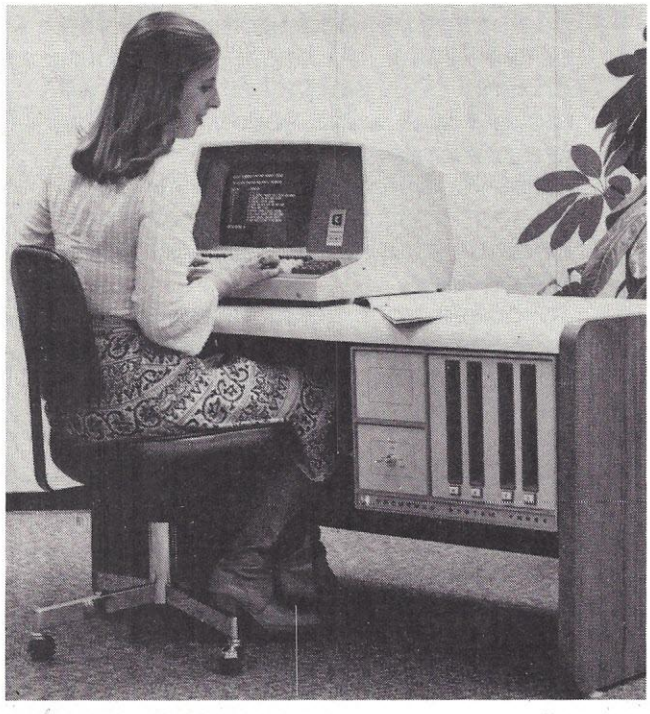
All of these features are also contained in Edmund's new "Sound/Off" Power and Temperature Monitor — plus a thermostat that is adjustable from 100- to 400- F, and a remote sensor that provides an over and under temperature alarm.

"Sound/Off" Power Monitor is priced at $59.95 postpaid. "Sound/Off" Power and Temperature Monitor is priced at $99.50. Add $1.00 for handling. For more informa-

tion contact Edmund Scientific, 7782 Edscorp Bldg., Barrington, NJ 08007. *Circle No. 162*

Computer Desk

Cromemco now offers a computer desk for the System Three and other Cromemco computers. The computer is mounted



into a special shelf under the desk, leaving the top free for a terminal, printer or other unit or as a work surface. The operator still has easy access to the computer for disk loading and unloading.

The desk top is beige, designed to harmonize with the medium-light wood veneer ends. The top surface is laminated plastic.

The desk, Model Z3-MDSK, is available for $695. For more information contact Cromemco, Inc., 280 Bernardo Avenue, Mountain View, CA 94043; (415) 964-7400. *Circle No. 163*

Credit Card Calculator with Alarm Clock Features

A tiny, credit card-sized calculator from National Semiconductor Corporation's Consumer Products Division combines calendar, stopwatch and alarm clock features for $49.95.

Designated NS106, the unit includes a calculator; a clock displaying time of day as well as date; an alarm to remind the user of appointments or elapsed time periods; and a stopwatch, which registers in tenths of a second, to indicate lap times or splits.

This slender calculator, 4.3 mm thick, features eight digits with floating decimal, percent key with add-on and discount capability, and memory.

The clock feature, which operates constantly, indicates time of day and includes a pulsating second counter. Just to the left, and appearing at the same time as the hour and minutes, is the day of the month and an abbreviation for the day of the week.

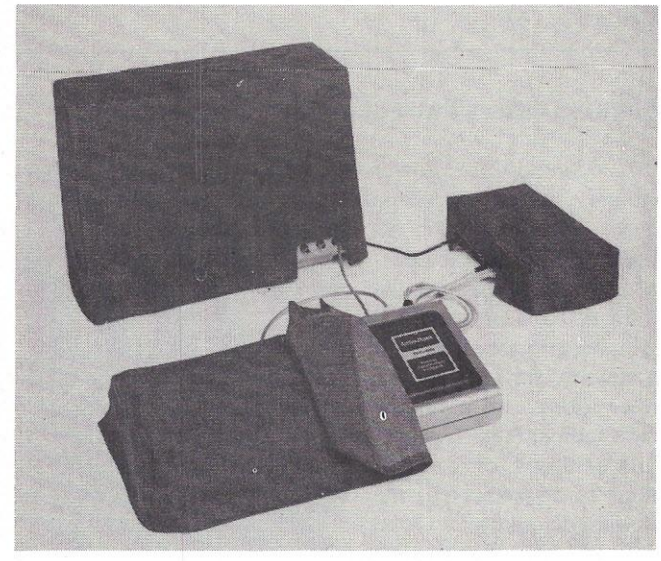
The stopwatch features a lap key for error-free timing of one or two splits in a single event. When the lap key is in operation, the stopwatch continues timing the full event.

For more information contact National Semiconductor, Consumer Products Division, 1120 Kifer Road, Sunnyvale, CA 94086. *Circle No. 164*

TRS-80 Fabric Dust Covers

August Automation announced its line of fabric dust covers for the TRS-80. Individually made from velour, corduroy or denim in a variety of colors, the covers keep dust from sensitive components, yet allow heat buildup to escape.

They are precisely fitted to the keyboard, the video display and the tape drive. Slots are present around all cables so they needn't be disconnected — just slip the covers on.



Static is not a problem for these covers, the company said. All are machine-washable and pre-shrunk.

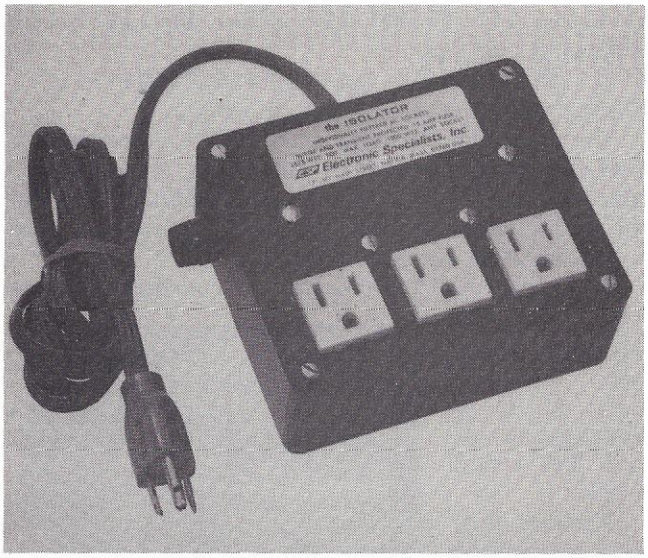
Current options are red, maroon, green or gold velour; blue or brown corduroy; and blue denim. Send $19.95 for each 3-piece set. Add $1 for shipping regardless of the quantity ordered. Massachusetts residents add 5% sales tax. Contact August Automation, 42 West St., Westboro, MA 01581; (617) 366-2431. *Circle No. 165*

The ISOLATOR from Electronic Specialists

Electronic Specialists has introduced the ISOLATOR, comprising 3 individually filtered 3-prong AC sockets with integral surge suppression. With each socket isolated from the other sockets, equipment interactions are eliminated, yielding error-free and glitch-free operation. The ISOLAT-

OR is valuable for isolating the microprocessor from peripherals as well as isolating disruptive line hash and damaging power line surges.

Connecting to the 120 VAC line with a standard 3-prong plug and 15 amp fuse, the ISOLATOR can accommodate an 1875 watt total load, with each socket capable of handling a



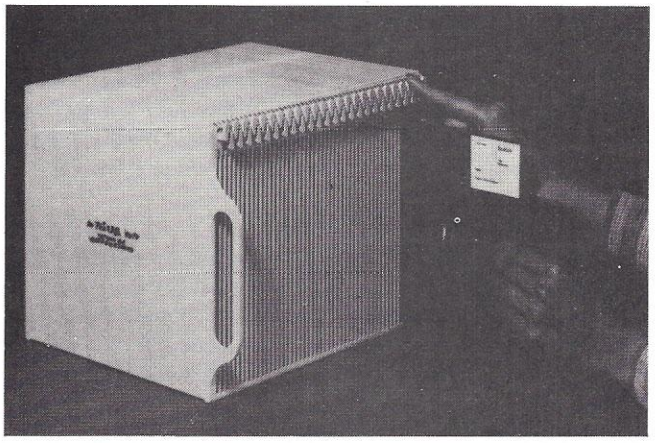
1000 watt load. Interaction-free AC line hash and line surge protection can be installed for $49.95.

For more information contact Electronic Specialists, Inc., 171 South Main Street, Natick, MA 01760; (617) 655-1532. *Circle No. 166*

Push Button Diskette Retrieval

A diskette storage system that features retrieval at the push of a button has been announced by Printcraft Systems, Inc. The high-impact plastic housing is portable and stackable.

The units are available in three storage capacities: 15-slot unit for $69.95; 30-slot unit for $119.95; and 50-slot unit for



$179.95. For more information contact Printcraft Systems, Inc., 11-17 Beach St., New York, NY 10013. *Circle No. 167*

SOFTWARE

Apple Graphics Utility Set

Hires Graphics Utility Set is a collection of programs designed to facilitate use of Apple II's high resolution graphics. The set includes:

- Software Controlled Character Display — permits display of lower case, APL, Russian, Japanese, mathematical notations or other characters, all under software control using a fast assembly language routine.
- Shape Vector Table Assembler and Editor — lets you edit, create, store and display high resolution forms with user-controlled memory location, color, shape, scale, rotation, overlay and append features. Applications include games, teaching programs and animation projects.
- Find Utility — returns current position on the screen and determines if a point is plotted there.

This utility set requires 4K Apple II Integer BASIC and standard hires graphics routines (INIT, SHAPE, POSN, CLEAR). The set of five programs on tape with manual costs $9.95. Contact Soft-One, 315 Dominion Drive, Newport News, VA 23602. *Circle No. 168*

Aresco PET BASIC Compleat

PET BASIC Compleat, a PET accessory for beginners, consists of twenty lessons in PET BASIC, including all the major BASIC keywords, cursor control, screen editing and use of graphic characters. About 400 screensful of information are contained in this 2-cassette tutorial. The 170-page manual which accompanies the cassettes reproduces all 400 screensful of data (except graphics).

Price is $39.95 for the package. Contact Aresco, P.O. Box 43, Audubon, PA 19407; (215) 631-9052. *Circle No. 169*

Disk Operating and File Management System for 6800 Microcomputers

Percom Data Company announced an advanced disk operating and file management system for the 6800 microcomputer.

Called INDEX (INterrupt Driven EXecutive), the system executes faster than most disk operating systems because the console and other I/O devices are services by interrupt requests instead of by polling, the company said.

INDEX, which supports unlimited DOS commands, includes features found in advanced disk management systems. For example, I/O devices and other system peripherals are treated the same as disk files, allowing the user to change I/O devices or add new devices without modifying the operating system.

A user can expand INDEX by adding utility commands and driver routines. These reside on diskette and are loaded into memory only when needed. This feature permits enhancement of the software without replacing the entire program or adding more memory.

Files can be assigned an activity value as a parameter of the file name, and the user may thereby list or display only the file directory entries at or above the activity level he specifies in the DIR (directory listing) command.

INDEX handles both ASCII and binary files. Disk files are automatically created, allocated and de-allocated.

Files are referenced by names of up to eight characters, and file name parameters are addended for name extension (to further define the file), drive number, directory level and a file protection flag.

The INDEX operating system software also features a Backup routine for copying files onto diskette.

The console interface segment of INDEX software supports any standard serial ASCII terminal and features Program interrupt; Operator Start, Stop and Skip display control; an interrupt-serviced, type ahead character queue buffer; and a secondary line editing queue buffer.

File management software provides more than 60 system entry points for program linkage and accommodates up to 16 simultaneous active data control blocks.

Versions of INDEX are available for PerCom LFD-400, Southwest Technical Products' MF-68, Smoke Signal Broadcasting Company's BFD-68 disk systems and Motorola's EXORciser development system.

System requirements include 8K RAM at address $A000-$BFFF; minimum of 8K RAM beginning at address $0000; ACIA console interface (SWTP MP-C interface); and SWTBUG or equivalent monitor.

INDEX is supplied on two mini-diskettes together with a user's manual for $99.95. Contact PerCom Data Company, 318 Barnes; Garland, TX 75042. *Circle No. 170*

New Utility Disk for Cromemco CDOS Users

Cromemco owners can handle disk directories and files easier and faster with the 11 utilities on the Gunn Utility Disk No. 1, according to the developers. This new machine language utility package, used with CDOS, will perform the following tasks:

- Alphabetize diskette directories.
- Create CMD files from directory to allow transferring or outputting selected file groups quickly and easily to any device desired, such as punch, printer, or other drives.
- Isolate bad diskette clusters into badcluster directory entries to keep them from interfering with diskette space allocation beyond the bad area.
- Recover/display erased directory entries.
- Map on console or printer the diskette clusters occupied by all or any selected file or group of files.
- Permit jumping to and executing programs at a hex address.

- Provide current date for use by any program with file access capability.
- Automatically eject diskette from selected drive(s) when desired.
- Cold boot from diskette in drive A.
- Output preselected number of form feeds to the printer.
- Set Diablo 1620/Qume Sprint 5 printer margin and paper movement parameters from the console.
- Suspend system operation at selected program points to allow positioning cut paper in printer.

All 11 major utilities are provided on a single minifloppy or 8-inch diskette, along with an instruction manual.

The $95 Gunn Utility Disk No. 1 is available from computer stores or directly from the distributor, Comput-R-Ware, Div. Ken Kirkpatrick Advertising Inc., 7910 Westglen, Houston, TX 77063; (713) 486-0291. *Circle No. 171*

Key-To-Disk Software for Micros

Phone 1, Inc., sells Key-to-Disk Software (P1-KTDS) designed to run on 8080 and Z-80 microcomputers. The software supports 4 CRT Terminals, 4 floppy disk drives, line printer and 3780 communications.

The P1-KTDS package allows up to 4 CRT users to define and select as many as four screen formats per user. Each format may contain as many as forty user specified fields. Constant data fields may also be specified.

In addition to data entry, data verification is also included as a feature of the system. Verification is done on each field specified as a verify field whenever the verify option in enabled.

Each of the 4 users has a separate diskette drive that stores the formats and data records for the particular CRT assigned to the drive.

P1-KTDS software is currently shipping on Phone 1's P1-5 Data Concentrator, which utilizes the 8080 microcomputer, 8214 and 8529 interrupt controllers, 8251 terminal and printer controllers. Mylar decals, for attaching to the front edge of CRT keytops, guide the user in efficiently entering data.

P1-KTDS source module on CPM or FDOS III compatible diskette, limited-use license, user's manual, and four sets of keyboard decals are priced at $2500. User's manual is available separately at $35. For additional information contact Phone 1, P.O. Box 1522, Rockford, IL 61110; (815) 926-8927. *Circle No. 172*

Wang "General Business Systems" Software

Wang Laboratories, Inc., announced that General Business Systems (GBS) software, a comprehensive modular set of accounting systems, is now available on the 2200 MVP and VS computers. The GBS software features multiprocessing, multi-terminal access methods for companies needing a cost-effective solution to business accounting problems, Wang said. GBS is an interactive application system, providing up-to-date business information. This allows a manager to forecast, adjust and reforecast promptly to aid decision making said the company.

Available in various modular arrangements, both GBS/MVP and GBS/VS offer the following applications: Order Entry, Inventory Control, Invoicing, Accounts Receivable, Sales Analysis, Accounts Payable, General Ledger and Payroll. All information is stored on removable hard disks for filing procedures and system security back up.

GBS/MVP, written in BASIC, allows up to eight workstations and offers a maximum of 256K memory. GBS/VS, written in COBOL, features virtual storage for the equivalent of one million bytes of available memory per operation. GBS/VS allows up to 32 workstations giving each operator one-to-one responsiveness and offers a maximum of 512K real memory.

With the aid of Wang software consultants, each General Business System is specifically adapted to the procedures of each business, by incorporating a minimum number of modifications. Since GBS is a comprehensive flexible system, it offers built-in functions to accomodate special requests such as disputed invoices, debit/credit memos, non-inventoried products, unusual service charges and general ledger expense distribution.

Estimated prices for each module vary according to installation support and degree of customization desired by 2200 MVP and VS users. For further information contact your local Wang Computer Sales Office; or Wang Laboratories, Inc., 1 Industrial Ave., Lowell, MA 01851. *Circle No. 173*

Math Functions for Science and Engineering

DPFUN is a comprehensive 16-digit precision scientific subroutine package written for Microsoft extended and disk BASIC interpreters, including TRS-80 Level II BASIC. The thirteen double -precision exponential, logarithmic, trigonometric and inverse trigonometric functions provide a valuable utility for serious engineering and scientific applications. DPFUN uses truncated continued fraction algorithms and employes 64-bit binary floating point notation. The complete set of subroutines occupies approximately 2.5K.

DPFUN, source code only, is available for $10 postpaid from Miken Optical Company, 53 Abbet Ave., Morristown, NJ 07960; (201)267-7600. *Circle No. 174*

Graham-Dorian Business Software

Graham-Dorian Software Systems has developed four complete software program packages for payroll, inventory, cash register and apartment management.

All programs are compatible with any Z-80 or 8080 CP/M system, and can be ordered on standard eight-inch disk either double or single density or on mini-floppy disk.

Each program package contains a disk with CBASIC-2 compiler, CBASIC-2 run command and the Graham-Dorian software program in INT and BAS file form, plus a user's manual and hardcopy source listing.

Inventory Package gives a detailed listing of items in inventory and goods sold, including which salesperson sold what, when it sold and for how much; recaps activity; investigates and changes any information in inventory; prints lists of items for re-order; provides profit analysis comparing sales personnel and/or various products. It can be inter-connected with the cash register package for total program management.

Payroll Package maintains file of all active and terminated employees; computes payroll data such as overtime, adjustments, deductions for taxes and insurance; types checks and maintains a variety of information on each, allowing for add-on amounts; lists checks by number or date written; provides check stub information; gives total payroll and breakout by division; and allows for data printout.

Cash Register Package maintains files on daily sales of an unlimited number of sales personnel; types daily sales reports; graphs gross income per month; files data on refunds, overrings, paid outs, and total net deposits; and is designed for expansion. It automatically deducts items out of inventory as sold.

Apartment Package maintains complete files on all tenants with daily reports of vacancies, late rents, security deposits, income for the day/month/year to date; checks and verifies manager's totals, checks for missing receipts; stores information on past tenants; allows monthly comparison with previous year; and types letters and address labels to categorized tenants.

The four programs sell for $695 each. One CBASIC-2 is

free with a program order; others cost $89.95 each.

All packages are described in a literature packet available free from Graham-Dorian Software Systems, 211 N. Broadway, Wichita, KS 67202; (316) 265-8633. *Circle No. 175*

Two Systems for Management

R.A.I. Business Systems, Inc., has introduced two software systems for management.

The first is a comprehensive Financial Forecasting System designed specifically for non-technical managers.

Called Horizon, the program enables managers to create accurate financial, budgeting and sales reports, eliminating the need for programming support. Variations of either report parameters or report data fields can be introduced at the CRT then the report can be rerun and evaluated in a matter of minutes.For reviewing the results of each change made, the operator can display the report, reflecting the changes made, to determine whether it should be printed.

Horizon uses English-oriented commands and tutorial prompting in continuous interaction with the operator. It immediately signals if a procedureal error is made. Compatible with all Datapoint computers, it currently sells for $5500, plus $1000 installation and operator training. An operator's manual is provided.

R.A.I.'s second system is a fully-integrated Management Accounting & Reporting System (MARS).

MARS is comprised of fully-integrated programs for Accounts Payable, Accounts Receivable, General Ledger Payroll, Order Entry, Invoicing, Statements, Sales Statistics, Inventory and Purchasing. All subsystems post to General Ledger automatically, eliminating time-comsuming double-entry errors, according to the company.

MARS uses English-oriented commands and tutorial prompting in continuous interaction with the operator. It immediately signals if a procedural error is made.

MARS, fully compatible with Datapoint computers, sells for $10,000, plus $1000 installation. Operator's manuals are included.

For more information contact R.A.I. Business Systems, Inc., 130 U.S. Highway 22, North Plainfield, NJ 07060; (201)561-9100. *Circle No. 176*

Employee Productivity Evaluation

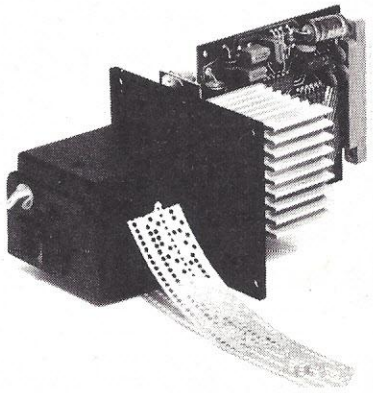
Kearny Management Consultants, with Donald B. Cook and Associates, introduced an approach to improving employee productivity. Called "Productivity Evaluation Program" (PEP), the system is designed to identify opportunities for productivity improvement throughout a business.

PEP allows managers to monitor not only productivity, but also review work backlog, output quality and manpower requirements. It can be used as a business planning tool to develop variable budgets, to provide manpower projections and to analyze causes for variance from planned budgets.

Because of its flexibility, PEP can be used to measure employee output for previously "unmeasurable" white collar positions. PEP measures trends of employee output, rather than performance against an absolute standard, said a

$231 PAPER-TAPE READER HAS ONE MOVING PART

This paper-tape reader comes with TTL interface and has only one moving part. It reads any standard tape at 150 cps, asynchronous. Bi-directional, the unit stops on character and automatically detects taut tape and end of tape. The reader's user-furnished clock input is a positive-going pulse that advances tape at the input's negative-going edge and



may also strobe the output data. Power requirements are +5V at 200 mA and 24V at 600mA. Stand alone versions with parallel or serial RS 232 outputs, fanfold box and spooler are also available. Price $231 (100 units). Addmaster Corporation, 416 Junipero Serra Drive, San Gabriel, CA 91776. (213) 285-1121.

CIRCLE 29

Kearney official. Information is supplied on a daily, weekly and annual basis.

For more information contact A.T. Kearney, Inc., 100 South Wacker Dr., Chicago, IL 60606. *Circle No. 127*

A Full Function RSX-11M LSI-11

Plessey Peripheral Systems announced the RSX-11M, which permits RSX-11M to run on an LSI-11 system. LSX-11M is an operationally compatible extension of RSX-11M with the capabilities of supporting all peripherals normally supported by RSX-11M, and up to 28K of memory. LSX-11M is designed for users requiring an inexpensive processor to run and develop RSX-11M programs. In addition, all of RSX-11M executive functions and file operations which were not supported by RSX-11S for the LSI-11 are now supported, so that a user can run software developed for RSX-11M on the LSI-11. Conversely, programs developed under LSX-11M on the LSI-11 will run on the PDP-11/34 or other PDP-11 CPU with RSX-11M.

LSX-11M, like RSX-11M, offers a complete multi-user program development facility as well as a real-time user environment. The system's task scheduling mechanism recognizes 250 software priority levels which enables the user to compile, debug and install tasks without affecting a real time task response. Tasks can be written in Macro-11 assembly language, or optionally in FORTRAN IV. An additional feature is a powerful batch-like facility. LSX-11M is available now with a category C license (includes media and documentation but unsupported) for a list price of $2330.

For more information contact Plessey Peripheral Systems, 17466 Daimler, Irvine, CA 92714. *Circle No. 128*

File Independence Facility for DOS/VS Users

The file independence facilities of CA-DYNAM/FI,from Computer Associates, allow DOS/VS users to redefine the physical attributes of any sequential file at the time of execution without making any changes to the original program.

File independence is activated by simple additions to the JCL or through its catalog. CA-DYNAM/FI provides the following facilities:

- Existing block sizes may be reblocked according to user JCL specifications without modification to programs. The user may also specify that the block size be "optimized" according to device type.
- CA-DYNAM/FI dynamically allocates single or double buffering for the defined file.
- A unit record device can be simulated to a tape file, a sequential disk or sequential VSAM file.
- CA-DYNAM/FI is able to allocate records to or retrieve records from a VSAM file even when a nonVSAM file is defined in the program.
- At the user's option, CA-DYNAM/FI can release an assignment of a logical unit when the file is closed, thus making the assigned drive available for use immediately.
- CA-DYNAM/FI has its own catalog. This allows the user to specify in the catalog a variety of file attributes bypassing the need to modify JCL.

• With CA-DYNAM/FI the user may set default sizes for DOS/VS EXEC statements that have no size operand.

• At the installation option, an audit trail data-set can be created and maintained indicating the processing performed by CA-DYNAM/FI for any given file.

• CA-DYAM/FI provides a report generator program which creates user-defined reports relating to CA-DYNAM/FI processing. Simple control commands enable users to tailor reports to their own specifications.

For further information contact David Wardle, Vice President of Sales, Computer Associates, 655 Madison Ave., New York, NY 10021; (212) 355-3333, or the toll free number (800) 221-4767. *Circle No. 196*

Motorola's New Resident CRT Editor

Motorola Microsystems has announced a new Resident CRT editor, the M6800EDITORM, which will allow the M6800 EXORciser or EXORterm to create and modify source programs. The editor is designed specifically for use with the EXORterm 200 and 220 development systems, or in an EXORterm 150/EXORciser system.

Each system provides the means of monitoring, controlling and debugging user-defined machine operations, as well as providing the basic control and interface function of a microcomputer system.

Source programs can be loaded into system memory from the keyboard, optionally listed with identifying line numbers on the CRT screen and/or line printer, and modified with edit commands from the keyboard. A text editing feature of the resident CRT editor is its ability to search through a source program and point to a specific character, or group (string) of characters, as well as entire lines or groups of lines.

In addition, block moves, verification of editing changes, tabbing, horizontal/vertical range editing and CRT keyboard text modification are also available.

The M6800EDITORM is available only on Motorala Disk Operating System (MDOS) diskette and requires an EXORciser/EXORterm with 32K RAM capability.

Unit price is $300. For additional information contact Motorola Microsystems, P.O. Box 20912, Phoenix, AZ 85036; (602)962-2223. *Circle No. 129*

Integrated Microcomputer Accounting System

An Integrated Accounting Software System for microcomputers is now available from Peachtree Software, a division of Retail Sciences, Inc.

The system is organized into four packages — General Ledger, Accounts Payable, Accounts Receivable and Payroll. Each of the packages may operate in a stand-alone fashion or they may be combined to provide automatic financial reporting.

General Ledger, the heart of the system, keeps a detailed record of all financial transactions and generates the Detail Ledger, Balance Sheet and Income Statement. At the user's option, the General Ledger package will also provide historical and departmentalized financial statements. The Accounts Payable package keeps track of current and aged accounts

payable and incorporates a check writing feature. The Accounts Receivable package is an invoicing and monthly statement generation package. Customer accounts may be either balance forward or open item. The Payroll package prepares the payroll for various pay types and pay periods while accumulating the information for tax reporting.

The software, written in Microsoft BASIC, executes under the CP/M Operating System or equivalent. Hardware requirements include an 8080-compatible processor with 48K RAM, 132 column printer, video terminal and a minimum of 0.5 megabytes of online disk storage.

The software is available from retail computer stores and consultants across the nation. Contact Retail Sciences, Inc., Suite 419, 3384 Peachtree Road, N.E., Atlanta, GA 30326; (404) 231-2303. *Circle No. 130*

Advertising Message Program for Apple

A new cassette computer program converts an Apple computer system into an automated advertising machine for retail stores, restaurants, banks, hotel lobbies and trade shows. The program, called "Multi-Message with Interleaved Kaleidoscope", permits 10 messages (up to 255 characters each) in letters 10% of screen height x 4 lines x 28 characters/line. There can be up to 3 "pages" per message. Characters are "puffed" on at the rate of 2 per second, and appear in a bluish-white tint on color TV.

A random, dynamic, colored kaleidoscope pattern (of user-determined duration) attracts and holds viewer attention between messages. Instructions for setting up messages are "intermixed" with program code on the cassette, and also appear on screen, so that unsophisticated users are actually "led through" the operating procedure, rather than following "pre-instruction". For more information contact Connecticut Information Systems Co., 218 Huntington Rd., Bridgeport, CT 06608; (203)579-0472. *Circle No. 131*

Real-time Event Drive Executive

REDX-80 (Real-time Event Drive Executive) is a real-time, multi-tasking executive designed specifically for 8080/Z-80 based microcomputers. It provides a system design tool for industrial applications such as process control, real-time manufacturing monitoring and data collection systems, where the program requirements of real-time interrupt processing, concurrent execution of multiple programs and sharing of system resources, have been a major handicap, said the devleopers.

The REDX-80 provides a mechanism to achieve real-time activation of tasks, concurrent execution of tasks, intertask communication, intertask synchronization and interrupt handling. Under REDX-80, up to sixteen user-defined tasks are allowed to exist concurrently and share system resources. Each task is assigned an identification number, a two character task name and a priority level from 0 through 7, with 7 being the highest priority. A task with a higher prioity level can preempt the current executing tasks of a lower priority. This feature allows immediate response to tasks with the greatest resource demand.

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CIRCLE 36

WANTED:

BUSINESS PROGRAMS

Our readers want your business applications programs. Chances are, the software you've developed to solve your business problems will also help someone else faced with a similar problem.

Consider how your business benefits from your microcomputer — not only in the obvious area of inventory, accounting and payroll, but in all departements and levels right up to the president's desk. Financial and marketing analysis, time management, planning, material handling, product design and cost accounting are areas ripe for creative programming. Readers want help with all of these problems.

So why not share your solutions with our readers? Send us an article describing the problem you faced and how you used your microcomputer to solve it. Be sure to include a program description, program listing and sample run.

Remember, readers aren't familiar with your program. So explain in detail what the program does and how it does it. Include here the overall structure of your program as well as any special algorithms or routines you've used. Give suggestions for modifying or expanding the program for other applications, other businesses or other situations.

All submissions should be original typed (not all CAPS), double-spaced and neat. Include your name and address on the first page of the article and enclose a self-addressed, stamped envelope for return of material. Also, please use a fresh ribbon on your printer for program listings and sample runs.

Feel free to call us at (617) 232-5470 if you have any questions or want to discuss specific article ideas.

Mail your manuscript to:

Editor
Personal Computing
1050 Commonwealth Ave.
Boston, MA 02215

The REDX-80 provides intertask communication through a mechanism called Channel. The mechanism may be used to achieve task communication, task synchronization and task exclusion.

The system utilities that are available for incorporating user tasks into the REDX-80 can be categorized into five distinct groups: Task Scheduling, Intertask Communication, Interrupt Processing, Memory Management and General Utilities.

Two versions are offered — the 8080/8085 REDX-80 and the Z-80 REDX-80Z. Both versions are supplied with the Intel ISIS-II object format. The user program may be written as a separate program module and may be linked with the REDX-80 object module using LINK and LOCATE facilities. The REDX-80 object module is currently less than 1.75K bytes and requires only 256 bytes of RAM for its operation. The REDX-80 may also be supplied in object format which is created by using the Microbench Cross Assembler on the PDP-11 series computer.

In addition to the REDX-80 object module, a set of macro libraries, which contains the system directives for using the REDX-80 utility, as well as assembly time directives for building user tasks under the REDX-80, will be supplied. The one-time non-exclusive license fee for the REDX-80 is $1500 and the source code can be purchased at a one-time charge of $7500. Outside training on the operation and application of the REDX-80 is also available.

For further information contact Systems Software, Inc., 2801 Finley Road, Suite 101, Downers Grove, IL 60515; (312) 932-9320. *Circle No. 177*

Dynamo for Micro-Computers

Pugh-Roberts Associates, Inc., is offering Dynamo tailored for the Digital Equipment PDP-11V03, MINC, and other LSI-11-based micro-computers. It is used in modeling and simulation of industrial, social and engineering systems. Recorded on eight-inch flexible diskettes, the micro-computer version of Dynamo operates on systems using the RT-11 operating system and can be converted to similar systems such as the Heathkit H-11 computer.

Because of the relatively inexpensive hardware involved, a Dynamo simulation capability can be provided in classrooms, small business and engineering groups. Mini-Dynamo can be licensed from Pugh-Roberts Associates, Inc., 5 Lee St., Cambridge, MA 02139. *Circle No. 178*

Macro Assembler for 8080/Z80

MACRO-80 from Microsoft is an 8080/Z80 assembler incorporating many "big computer" assembler features. The 14K assembler, which comes in a package that includes a linking loader, library manager and cross reference facility, assembles over 1000 lines per minute.

The system supports a complete, Intel standard macro facility, including IRP, IRPC, REPEAT, local variables and EXITM. Nesting of macros is limited only by memory. Code is assembled in relocatable modules manipulated with the flexible linking loader. Conditional assembly capability is

enhanced by an expanded set of conditional pseudo operations that include testing of assembly pass, symbol definition and parameters to macros. Conditionals may be nested up to 255 levels.

Other features include comment blocks, variable input radix from base 2 to base 16 (instead of the usual decimal), titles and subtitles, variable page size, octal or hex listings, PRINTX for printing assembly or diagnostic messages, and PHASE/DEPHASE to allow code to reside in one area of memory but execute in another. Another feature is MACRO-80's ability to accept both 8080 and Z80 opcodes, selectable with a pseudo-op or command switch. Various listing control statements give the user complete control over assembler output.

The MACRO-80 package — including assembler, linking loader, library manager and cross reference facility — is priced at $200 for single copies. (MACRO-80 is included in the purchase of Microsoft's FORTRAN-80.) For more information contact Steve Wood, General Manager, Microsoft, 10800 NE Eighth, Suite 819, Bellevue, WA 98004; (206) 455-8080. *Circle No. 179*

New Software for General Accounting System

National Software Marketing, Inc., announced four more Inflation Fighters products for Wang users. The packages join their previously announced General Accounting System that consisted of four $200 modules: Payroll, General Ledger, Accounts Receivable and Accounts Payable. The new products are: General Ledger ($130); Payroll ($50); Word Processor ($50); and Financial Calculations and Mortgage Amortization ($50). These systems are available on either 5-inch or 8-inch floppy disks.

The Inflation Fighters are sold with a 30-day return privilege. A $5 charge is added to handle shipping costs per order. For a nine-page brochure of sample outputs write to Elliot Kleiman, National Software Marketing, Inc., 4701 McKinley St., Hollywood, FL 33021. *Circle No. 180*

Z-80/8080 Word Processing Designed for Business World

Autoscribe, offered by MicroSource, a division of the Phoenix Group, is a professional word processing system designed for the business world. With Autoscribe, the company said, time consuming corrections and retyping can be done quickly and accurately. Standard documents can be assembled from pre-recorded paragraphs or entered directly from the keyboard. Typed text appears on a video terminal screen as it will be printed and corrections, deletions or revisions can be made quickly. When it's letter perfect, the finished document is typed at hundreds of words per minute.

Letters, contracts and other documents can be produced on single page or continuous form print-out. Original data is recorded and saved on the user diskette. Documents can be retrieved instantly and reprinted as needed.

A secretary or typist can learn to use the system in two hours, the company said. No computer language is needed. All instructions are in English. The software operates on

Z-80/8080 systems with North Star DOS, a Soroc or Hazeltine terminal and a letter quality printer (NEC Spinwriter or Diablo, for example).

Autoscribe is available at local computer stores. Contact MicroAge Wholesale, 1425 W. 12th Place, Tempe, AZ 85281; (602) 967-1421. *Circle No. 181*

BASIC-80 and Fortran-80 from Intel

Intel's Microcomputer Systems Division has added BASIC-80 and Fortran-80 to its software product line.

BASIC-80 adds to the utility of Intel's Intellec Microcomputer Development Systems by providing a facility for applications programming and problem solving, as well as an aid for microprocessor systems development.

Standard ANS 78 BASIC features provided by BASIC-80 include: string and numeric constants, variables and arrays; FOR. . .TO. . .STEP. . .NEXT statements for loop execution; IF. . .THEN statements for conditional execution; ON. . .GOTO statements for calculated branching; and GOSUB/RETURN for subroutine calls and returns.

The BASIC-80 extensions provide access to the Intellec system disk files for full sequential and random disk file input/output. They include support for the Intel single and double precision floating point standards and provide for integer and string data types with string manipulation capabilities. Language extensions include direct read and write of the CPU input/output ports, direct memory read and write through PEEK and POKE functions, a formatted print statement with the PRINT USING function, and IF. . .THEN statements extended with an ELSE clause.

Other BASIC-80 extensions include Boolean Operators and operation with matrices with up to 110 dimensions. To assist in debugging, Intel BASIC-80 also includes user directed error trapping and handling functions plus a program execution trace command.

BASIC-80 can be added to any of Intel's Intellec Series II or MDS-800 series microcomputer development systems with 48K bytes of RAM and at least one disk drive. The price is $750 for single or double density diskettes and accompanying manuals.

Fortran-80 Version 2.0 language and compiler meets and exceeds the ANS Fortran 77 Language Subset Specification ANS X.3.9-78, and adds capabilities in I/O interfacing and hardware floating point support. For floating point calculations, Fortran-80 can use Intel's iSBC-310 High Speed Mathematics Board.

A key advantage of Fortran-80 is its use in developing individual modules of a program which can then be linked together with other modules written in PL/M-80 and/or 8080/85 Assembly Language. Thus, a program developer can choose the most effective language for each program function, according to the company.

In addition to ISIS-II (the Intellec Microcomputer Development System's Operating System) I/O support, programs written in Fortran-80 can be configured with user-supplied I/O drivers. These can be record-oriented drivers which take advantage of the full Fortran-80 I/O capabilities and interface directly to the Fortran-80 language statements, such as READ, WRITE and OPEN. Alternatively, for savings in code size, programs can use the internal formatted I/O facilities along with user-supplied PL/M-80 or ASM 80/85 drivers.

Significant benefits of the Fortran-80 in support of the ANS Fortran 77 standard include: addition of the IF. . .THEN. . .ELSE statement; assignment of alphanumeric data in the same manner as numeric data; handling of sequential and direct access files; list directed formatting — the ability to read or write without a format statement; and support of the logical equivalence and non-equvalence operators and arrays of up to seven dimensions.

Fortran-80 Version 2.0 is available at $1750 for single or double density floppy diskettes and accompanying manuals.

For more information contact Intel Corporation, 3065 Bowers Ave., Santa Clara, CA 95051. *Circle No. 182*

P.C. BOARDS

Solid State Relay Module

Wintek Corp. has added a relay module to their line of 6800 single board computers and real-world interface modules. The relay module contains 4 solid state relays for switching 5 or 10 amps at 120 or 240 volts for computer control of motors, pumps, lamps, and so forth for energy control, traffic control, environmental controls, machine tool control and other applications. The relay module is one of 17 Wince modules on 4-1/2" × 6-1/2" boards with industry standard 22/44 pin connectors. The unit price ranges from $99 to $249 depending on options. Contact Wintek Corp., 902 N. 9th St., Lafayette, IN 47904. *Circle No. 183*

Single Board Graphics Imaging System

The Matrox RGB-256 is a complete color/grey scale imaging system integrated onto a single PC board.

The card features a dense 256 × 256 dot resolution with 4 bit planes on a single PC board. The card includes built-in NTSC (American) or PAL (European) color and grey scale encoders which can provide up to 16 shades or colors. The encoders permit the RGB-256 to directly drive standard low cost color or black and white TV monitors on a single 75 ohm cable.

In addition, the card includes an on-board phase lock loop which permits the output to be synchronized to an external video source such as a TV camera. This allows the RGB-256 to be used in broadcasting, CTV, or wherever its output will be mixed with other video signals, the company said.

Multiple RGB-256 cards can be combined to obtain more bits per pixel. Specifically, two RGB-256 cards can be combined to give 8 bit planes. The two card system with no additional hardware will give a total of 256 colors or grey levels.

The RGB-256 utilizes standard +5 V, and +12 V power supplies. It features the industry standard Intel Multibus which makes it directly plug compatible with all SBC bus computers. The manual provides complete details on the universal multibus which permits the RGB-256 to be interfaced to most other mini and micro computers.

For more information contact Matrox Electronic Systems Ltd., 2795 Bated Rd., Montreal, Quebec, H3S 1B5, Canada. *Circle No. 132*

Memory Card Adds Development Capability

Pragmatic Designs has introduced DBM-1, a memory card that allows use of any S-100 type computer as a memory emulator during program development for small, dedicated systems.

The DBM-1 is a 2K byte memory card accessible by both a development and an application computer. The development computer loads the memory with the applications program. This program can then be executed by the target computer. During debugging, the applications computer can be halted and the program changed using the development computer's monitor commands. This effectively extends the more powerful development computer "into" the application computer's memory, eliminating the need for time consuming EPROM programming during program development. Once the program is debugged it can be programmed into an EPROM and installed in the application computer. The DBM-1 can be used as normal system memory when not in use for development.

DBM-1 interfaces to the application computer via one or two EPROM sockets. The memory interface for the target computer looks like any one of four popular types of EPROM: 2708, 2758, 2716 and TMS 2716. There are sockets along the top of the board, and EPROM type is selected by the socket used. A 24-line cable connects the socket(s) on the DBM-1 to the EPROM socket(s) on the target processor.

A hardware address trap on the DBM-1 allows suspension of the target processor. The host processor sets the trap address using software. When the target processor accesses the trap address, an output signal on the DBM-1 is set. This signal can cause a program breakpoint by controlling the target processor's ready logic.

Two DBM-1s can be cascaded for applications requiring up to 4K of program memory. In these applications the breakoint logic is daisy chained, allowing the breakpoint to be set for any address in the 4K block.

DBM-1 plugs into the S-100 bus. The memories have an access time of 300 ns, allowing full speed memory emulation with virtually all popular microcomputers, the company said.

Prices for DBM-1 are $190 kit, $270 assembled and tested. A manual set describing DBM-1 and its use is $8, refundable with order. For more information contact Pragmatic Designs, Inc.,

711 Stierlin Rd., Mountain View, CA 94043; (415) 961-3800. *Circle No. 133*

Touch-Tone Telephone Interface

MK Enterprises has announced a Dual Tone Multi-Frequency (DTMF) transceiver board which interfaces your S-100 microcomputer to a Touch-Tone telephone. Designated the MK-11, the board converts Bell System's DTMF into binary and binary into DTMF, thereby making a fully operational Touch-Tone transceiver.

On incoming calls, vectored interrupts allow for ring detection as well as detecting the presence of DTMF signaling. This capability permits executing programs by calling up your computer and punching buttons on your Touch-Tone telephone. A 4-bit input port allows additional data to be transfered coincident with decoded DTMF.

On outgoing calls, digits dialed are loaded into a FIFO buffer at processor speed and unloaded into a DTMF generator at a rate compatible with Bell System's equipment.

Applications of the MK-11 include the monitoring and tabulation of outgoing phone calls, home security "dialers", and PABX systems. Remote operation of AC appliances is also possible by 60 cycle modulation with DTMF signaling.

The MK-11 comes fully assembled and tested with applications information and manual for $425. For further information contact MK Enterprises, 8911 Norwick Rd., Richmond, VA 23229; (804) 740-8380. *Circle No. 134*

Control Board for PET

A new interface card for use on Commodore's PET computers as a process controller for medium duty applications and for stepper motor operated devices has been developed by Nanco. The easy-to-install card allows a personal computer to fulfill a number of command tasks, the company said.

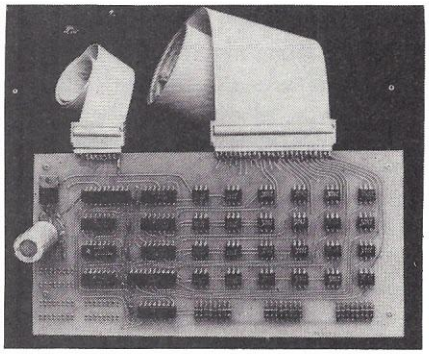
The two 4-phase stepper logic outputs are provided with eight opto-isolated sense input lines and eight opto-isolated output control lines.

A software driver module contains eight commands which facilitate control of two steppers, eight heavy duty relays or triacs, and eight input sense lines. All commands, which include rate select, stepper move, limit switch inputs, relay control, position index and execution command, are passed by the user function in PET BASIC.

The software module occupies 400 bytes and will run on any 8K or larger computer.

Power is supplied from computer

transformer to onboard 5 V regulator. The 4" × 8" board comes complete with mounting hardware, parallel user port and control cables. Three extra IC positions are provided for custom additions.



Options include power control unit containing stepper power supplies, heavy duty relays and I/O termination panel.

Suggested retail price is $199. For additional information, contact Nanco Diversified Design, 8380 Vickers St., Suite E, San Diego, CA 92111. *Circle No. 101*

New Floppy Disk Controller

Industrial Micro Systems announced a new single board floppy disk controller. The Model 400 DMA controller operates on the S-100 bus and uses IBM 3740 compatible soft-sectored formatting. The controller will handle single sided, double sided, single density and double density floppy drives and can handle up to four drives with overlapped seek capabilities to all four of the drives.

The controller has an on-board 1 Kbyte EPROM for boot programs or other user defined applications. A phase locked loop design insures accurate and reliable data recovery. The Model 400 controller is available in Industrial Micro Systems' systems compatible with CP/M and the UCSD Pascal System.

For more information contact Industrial Micro Systems, 628 N. Ecihoff St., Orange, CA 92668; (714) 633-0355. *Circle No. 102*

Video Display Interface

An S-100 compatible Video Display Interface (VDI) from Objective Design provides software control of screen presentation. The video board will create alphanumeric displays of 80 × 24, 64 × 16, 64 × 16, 64 × 32, 40 × 20 and other formats, all selected by programming. Each individual character has reverse video and 4 levels of gray scale.

Users can select via software a synchronized access mode which prevents snow and other screen disturbances when entering data. The program-set display parameters assure compatibility with any monitor — American or European standard, any number of scan lines, low or high resolution, interlace or non-interlace.

The character set is programmed in PROM, which can be replaced by the user. In addition, the VDI board is designed to combine with Objective Design's Programmable Character Generator card for a variety of characters and graphics. Maximum resolution is 512 × 512.

For additional information, contact Objective Design, Inc., P.O. Box 20325, Tallahassee, FL 32304; (904) 224-5545. *Circle No. 103*

Analog to Digital Converter Adapter Module for PET

The DAM Systems 16 channel Analog Input Module, the AIM16, can now be directly connected to the Commodore PET using the DAM Systems Petmod. This system provides low cost analog input for the PET. Joysticks, potentiometers, temperature sensors, accelerometers, pH meters and so forth can be connected to the PET.

Petmod plugs into the PET IEEE port and PET user port. The Petmod then has available two PET IEEE ports and one user port in addition to the DAM Systems port.

The Petmod is also called the Petsavr. Once plugged in, it can be left in, and the PET owner can use the IEEE and user ports on the Petmod, saving the fingers on the printed circuit board of the PET from becoming dog-eared, the company said.

Price is $49.50. Contact Connecticut microComputer, Inc., 150 Pocono Rd., Brookfield, CT 06840; (203) 775-9659. *Circle No. 104*

Serial Lineprinter Interface for LSI-11

A new lineprinter handler for the RT-11 operating system communicates via any DLV11 interface. The serial data transmit and receive lines are all that are required. Functions are identical to those of the standard RT-11/V3B LP handler. Throughput is limited only by the printer.

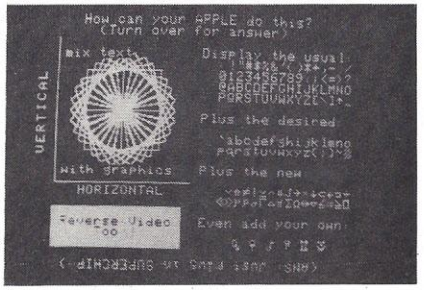
A personality module plugs into the printer and accepts a 25-pin RS-232 connector from the computer. Modules for the Texas Instruments 810 Lineprinter are currently available. Software is distributed on floppy disks.

Price is $120. Contact Salcris Corporation, P.O. Box 43247, Birmingham, AL 35243. *Circle No. 105*

"Superchip" for Apple Computer Adds Text Processing

A "Superchip" has been developed which enhances the text processing capabilities of the Apple computer.

The ROM firmware chip, which plugs into an Apple computer without modification, adds the full ASCII character set including lower case, plus 31 non-ASCII characters. It also adds editing capabilities for program and data modification. The chip is compatible with existing Apple programs — Integer BASIC and Applesoft.



Used in conjunction with a character edit cassette, "Superchip" allows the user to define a new characters in a magnified format. A user can create entire character sets, such as foreign alphabets (Greek, Russian, Arabic), musical notation and game pieces.

"Superchip" costs $99.95 and the character edit cassette, $24.95, plus shipping charges. For additional information contact Eclectic Corporation, 2830 Walnut Hill Lane, Dallas, TX 75229; (214) 358-1307. *Circle No. 107*

Video Digitizer and Color Graphics System

Digital Graphic Systems announced the Cat 100/C, an integrated, expandable, general-purpose video imaging system for the S-100 bus. The basic configuration consists of two standard-size S-100 boards. It offers features including high-resolution standard color video output.

The Cat-100/C accepts standard monochrome TV signals as input with a variety of synchronization choices; the automatic composite sync extractor will operate on EIA RS-170, RS-330, or random interlace sync. Two selectable A/D conversion circuits provide a choice of 1, 2, or 4 bits per pixel at maximum video rate, and a complete video frame can be digitized in 1/60 of a second.

Thirty different graphic formats are selectable by software for digitization as well as for display, and resolution range from 256 to 1280 pixels per TV line. Typical formats include 240 lines of 256 pixels of 4 bits and 480 lines of 512 single-bit pixels. The on-board 32K-byte graphic/alphanumeric buffer is fully accessible for image generation or processing in the address space of the S-100 bus through an adjustable window which can be made as small as 2K bytes. The buffered image can be generated either by the built-in video digitizing circuitry or by the S-100 processor using graphics software. This image can be displayed in 16 shades gray or 16 colors on standard video monitors.

The Cat-100/C also has 2K bytes. The buffered image can be generated either by the built-in video digitizing circuitry or by the S-100 processor using graphics software. Maximum text density is 34 lines of 80 characters per screen. A scrolling feature allows scanning the entire 32K-character buffer with variable speed. Other features include a proprietary photographic trigger control input and a lightpen input providing 18 bits of x-y coordinates.

Prices start at $750. For more information contact Digital Graphic Systems, 595 Matadro Ave., Palo Alto, CA 94306. *Circle No. 106*

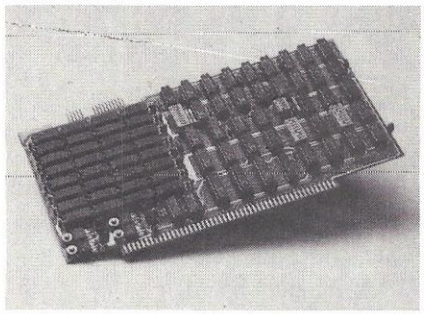
Alpha Micro 64K Dynamic RAM

Alpha Micro announced an S-100 bus-compatible 64K byte dynamic RAM memory board.

The new memory, called SupeRam, is manufactured by Piiceon, Inc., and is

being marketed by Alpha Micro's dealer network. It is completely compatible with the 16-bit Alpha AM-100 CPU.

SupeRam, a high-density random access memory, stores up to 65,536 bytes of data on a single board. It utilizes 16K dynamic RAMs to achieve maximum bit density, minimum power dissipation and optimum cost/performance ratio, the company said.



Refresh requirements, satisfied on the board without support from the processor, are transparent to the user. Internal timings are generated on-board using digital delay line techniques. Memory is addressable as independent 16K blocks, providing maximum capability with existing Alpha Micro Systems.

For further information, contact Alpha Micro, 17881 Skypark North, Irvine, CA 92714. *Circle No. 108*

16K Static RAM for the S-100 Bus

Micro Diversions announced a 16K Static Memory Board featuring industry standard 2114 static RAM, Schmitt triggered buffers (offering high noise immunity, low power consumption and heavy load driving ability), independent dip switch mapping of each 4K memory block, and 0 to 6 wait states.

The unit comes with a full one-year warranty on parts and labor. Prices are $35 unpopulated, $349 kit, $395 assembled and tested. Add $30 for 300 nsec memory (4 MHz operation). Contact Micro Diversions, Inc., 8455-D Tyco Rd., Vienna, VA 22180. *Circle No. 109*

Data Modem from Potomac Micro-Magic

Potomac Micro-Magic, Inc., announced its S-100 bus compatible data modem/communications adapter, the MM-103. The MM-103 is approved by the Federal Communications Commission for direct connection to the public-switched telephone network, the company said.

A user inserts in modem into the computer and plugs it into a telephone outlet. According to the company, it can originate and answer calls under software control, and it dials the telephone automatically.

Unit price is $319.95. For more information contact Potomac Micro-Magic, Inc., P.O. Box 11149, Alexandria, VA 22312. *Circle No. 110*

RAM boards in 16K, 32K, 48K and 64K bytes

Processor Technology has introduced a family of four dynamic RAM

boards — collectively designated nKRA RAM — with capacities of 16K, 32K, 48K and 64K bytes.

According to the company, a minimum of components are used to reduce probability of failure. Quality control includes screening incoming parts, complete functional test of boards, 48-hour dynamic burn-in at 140- F, visual inspection, another complete diagnostic test and maintenance of a test history for every board shipped.

Refresh is synchronous, so no wait states can slow the microprocessor. Switch-selectable addressing eliminates jumper wires and the need to power down when readdressing blocks of memory.

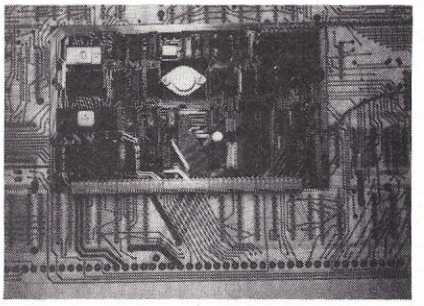
Board design permits future incorporation of bank select option. With bank select, memory may be expanded beyond 64 bytes with all memory on-line continuously. Large programs — such as FORTRAN or PL/M compilers — can be loaded.

Worst case access time is 400 nsec. Cycle time is 520 nsec. Power requirements are +8 to +40 VDC at 150 maximum and -15 to -19 VDC at 1 mA maximum, +15 to +19 VDC at 150 maximum and -15 to -19 VDC at 50 mA maximum.

Prices range from $429 to $1350. Delivery is stock to 30 days. Boards are available through Processor Technology dealers. For product literature, write Processor Technology Corp., 7100 Johnson Dr., Pleasanton, CA. 94566.
Circle No. 111

Alphanumerics/Graphics Display Board

F & D Associates announced the PMB-1, a memory-mapped alphanumeric and graphics display board for the SS-50 bus. Built around the Motorola MC6845 CRT controller integrated circuit, the board provides the following features: programmability via the processor bus; almost any display format such as 32 X 16, 64 X 16 and 80 X 24; on-board screen memory in 1K increments up to 4K; versatile addressing scheme; programmable cursor with various formats; blinking or non-



blinking; hardware or software scrolling, line by line or character by character; light pen input and register; on-board I/O port for keyboard, printer, joystick, etc.; interlaced and non-interlaced scanning modes; characters are stored in 2708 or 2716 EPROMs. Contact F & D Associates, 1210 Todd Rd., New Plymouth, OH 45654.
Circle No. 112

LITERATURE

Scelbi Software Update

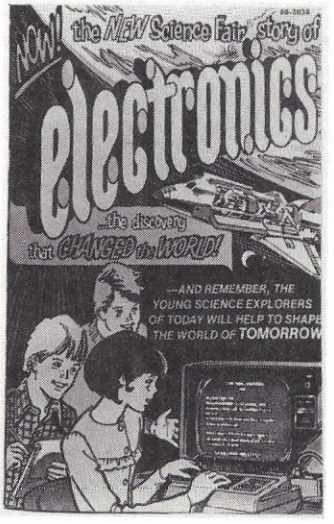
Hardcore Software Update from Scelbi Publications contains game programs, improvements for machine language programs, coverage of high level data base management systems and tips on getting the most out of your system.

Subscription is $10 per year. For more information contact Scelbi Publications, P.O. Box 133, PP STN, Milford, CT 06460. *Circle No. 113*

Free Comic Book from Radio Shack

An updated edition of Radio Shack's educational comic book, "The New Science Fair Story of Electronics . . . the Discovery that Changed the World!", is now available for free distribution to schools, clubs, youth groups and interested individuals.

The 24-page, full-color booklet traces the development of electronics from ancient times to the present, focusing on the human interest side of science. Important discoveries and the



people who made them are described in the easy-to-read narrative.

Topics included are magnetism, ancient use of batteries, electricity in nature, the development of "wireless" communications, TV, radar and the transistor, electronics in aviation and space exploration, and the computer age.

Included within the new edition are coupons which may be used to request additional copies, a membership in Radio Shack's free battery club, and a $1 gift certificate that can be used toward the purchase of any Science Fair or Archer kit at participating stores.

The new Science Fair Story of Electronics is available free from Radio Shack stores and dealers. Radio Shack, 1400 Tandy Center, Fort Worth, TX 76102; (817) 390-3272. *Circle No. 114*

Brochure on WordWizard

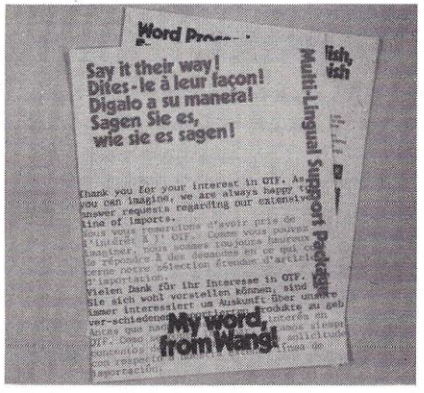
A brochure from Processor Technology describes WordWizard, an electronic typing system which increases the typing throughput in small to medium-sized businesses, reports the com-

pany. Instructions for making editing changes without lengthy retype, inserting stored "standard" language and typing automatically at 430 wpm are included. The brochure explains how to store up to 110 pages from up to 20 different documents and describes use by attorneys, accountants, sales offices and general businesses.

For more information contact Processor Technology, 7100 Johnson Drive, Pleasanton, CA 94566; (415) 829-2600. *Circle No. 115*

Flyer from Wang

A one-page flyer on Wang's Multi-Lingual support package is offered by Wang Laboratories. The Multi-Lingual option, for use on all Wang word processing systems, allows the user to operate in English, French, German and Spanish simultaneously. System prompts and menu are in the operator's



native language, and the keyboard, CRT display and printer are designed to include foreign language accents and special characters. For more information contact Wang Laboratories, Inc., One Industrial Avenue, Lowell, MA 01851; (617) 851-4111. *Circle No. 116*

ComputerMat Markets TRS-80 Software Source

ComputerMat offers a new publication listing computer programs for Radio Shack's TRS-80 computers. The TRS-80 Software Source lists over 125 sources of TRS-80 software.

The listings include the suppliers name, address, phone, program catalog number, level of BASIC required, memory required, program description and price for each program. Programs

are listed and grouped alphabetically by supplier, classification and media source (cassette or disk).

The listing is published three times a year in January, May and September. Each new issue will be updated with new sources and listings of programs available. The January issue contained over 125 sources of TRS-80 programs and over 800 programs.

Subscription price is $10 per year (3 issues) or $3.95 per issue. Contact ComputerMat, Box 1664, Lake Havasu City, AZ 86403. *Circle No. 117*

Heathkit Catalog

A 96-page catalog of electronic kits is available from Heath Company. Areas of interest for the kit-builder include color television, high fidelity components, amateur radio, test instruments, digital clocks, weather instruments, personal computer systems, auto, marine and aircraft accessories and a variety of products for home improvement and family entertainment.

New products in the catalog include a rack-mounted FM/AM stereo tuner, a DC to 35 MHz dual trace Delayed--Sweep Oscilloscope, new continuing education programs covering automotive electrical systems and the use of test instruments, a portable rechargeable fluorescent light, a solid-state heat/cool setback unit for home energy saving and a new FM deviation meter.

For more information contact Heath Company, Benton Harbor, MI 49022. *Circle No. 118*

Tape 'N' Text Modular Course Series on Basic Language

A new program series consisting of 12 cassette tapes coordinated with 12 printed texts, entitled *BASIC Programming Course*, is available from Williamsville Publishing Company.

The BASIC language tape 'n' text series is divided into three self-teaching modules: Programming in BASIC, Intermediate BASIC and Advanced BASIC. Each consists of 4 cassette tapes with 4 printed texts. In the first four-part program module the user is introduced to the most commonly used program instructions and commands. The module features sample programs

on various problem topics.

Author of the series is William R. Parks, assistant professor of information systems management at State University of New York College at Buffalo.

The second four-part module, *Intermediate BASIC*, covers TAB and PRINT USING function, structured programming concepts, subscript notation, list processing and user defined functions as well as other topics. The third module on *Advanced BASIC* covers subroutines, matrices and file processing.

The series sells for $48; individual modules for $19.95 each. For more information contact Williamsville Publishing Co., Box 237, Williamsville, NY 14221. *Circle No. 119*

Newsletter from Computalker

Computalker Consultants has published *The Word from Computalker*, a user newsletter.

The *Word* is a 16-page newsletter designed to open up two-way communication between Computalker Consultants and users of the CT-1 speech synthesizer and other interested parties. It contains items about CT-1 applications, new software, new hardware, software fixes, software written by users, and technical manual updates.

The premier issue of the *Word* is free to all who write for a copy. Five issues will be included with the purchase of each CT-1 speech synthesizer. Additional copies cost 60¢ each.

For further information contact Computalker Consultants, 1730 21st Street, Suite A, Santa Monica, CA 90404; (213) 392-5230. *Circle No. 120*

Lear Siegler Product Brochure

Lear Siegler's complete line of video display terminals, Ballistic printers and data systems are described in a brochure available from the company's Data Products Division.

Highlighted in the catalog are six video display terminals, ranging from the ADM-3A terminal — a data entry display terminal designed for asynchronous applications — to the VDP-4000 minicomputer-based intelligent ter-

minal with 16 user-programmable function keys, 20K to 30K bytes of ROM and 8K to 32 bytes of RAM.

The ADM-31 editing terminal and the ADM-42 semi-intelligent terminal are also detailed in the six-page publication. Both feature two full 1920 character pages of memory as standard. The ADM-42's memory can be optionally expanded to eight full pages. Each terminal has extensive editing capabilities and is preprogrammed at the factory for compatibility with many standard computer systems.

Also discussed is the VDP-410, a 16-bit CPU with enough speed and ports to support a variety of peripherals. Designed for system development, it provides the user with the flexibility to configure systems ranging from communications controllers without external storage capabilities to sophisticated time-sharing systems using a string of external devices.

For further information contact Lear Siegler, Data Products Division, 714 N. Brookhurst Street, Anaheim, CA 92803; (800) 854-3805; in CA, (714) 774-1010. *Circle No. 121*

APL Display Terminal Product Sheet

A new product sheet providing detailed specifications of the concept APL, an APL display terminal from Human Designed Systems, Inc., is available free from the company.

The concept APL offers a broad range of display features and applications support for the APL user. In addition to specifications of the display and keyboard, the terminal's standard functions, operating modes and options are spelled out.

The literature is available from Human Designed Systems, Inc., 3700 Market Street, Philadelphia, PA 19104; (215) 382-5000. *Circle No. 122*

Free TRS-80 Newsletter

The TRS-80 Club of Arlington, MA, offers a free newsletter. For a copy, send a long, stamped, self-addressed envelope. This April issue features word processing and business software. A 50¢ donation will be appreciated but not required. Write to TRS-80 Newsletter, 96 Dothan St., Arlington, MA 02174. *Circle No. 123*

Word Processing Accessories Guide

American Word Processing Company has announced the 1979 Edition of its *Guide to Word Processing Accessories and Supplies*. Among the 1200 items contained in this illustrated guide is an extensive selection of over 200 metal and plastic printwheels.

Some of the new products listed in

the Guide are American's own brand of plastic and dual plastic printwheels. A full selection of NEC Spinwriter Thimbles is also offered. Also included are data processing ribbons, as well as floppy and minifloppy disk storage and retrieval systems.

Obtain your free copy of this helpful 84 page guide by calling direct to (213) 705-2245 or writing to American Word Processing Co., 18730 Oxnard Street, Tarzana, CA 91356. *Circle No. 124*

TRS-80 Technical Reference Handbook

Radio Shack has published a technical reference handbook for their TRS-80 Microcomputer System. The illustrated, 108-page book is intended primarily for technically oriented persons with a good working knowledge of digital logic circuits.

Written in a straightforward, informal manner, the TRS-80 Microcomputer Technical Reference Handbook includes technical information and schematic diagrams for both Level-I and Level-II TRS-80 systems.

Topics covered in the book are: Theory of Operation, Adjustments and Troubleshooting, The Outside World (connections to external devices), Parts List and fold-out Schematics.

The 8-1/2" x 11" softbound handbook is priced at $9.95. It is available from Radio Shack stores and dealers. Contact Radio Shack, 1400 Tandy Center, Fort Worth, TX 76102; (817) 390-3272. *Circle No. 125*

Expanded Line of Workbooks for Commodore PET

A new workbook on *PET Control and Logic* covers testing and branching, subroutine use and logic operations. Binary-to-decimal and decimal-to-binary conversion programs are used to demonstrate the logical operations.

Other workbooks include: *Started with Your PET, PET String and Array Handling, PET Graphics, PET Cassette I/O* and *Miscellaneous PET Features*.

These workbooks range in price from $3.95 to $5.95. For more information contact TIS, P.O. Box 921, Los Alamos, NM 87544. *Circle No. 126*

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	sort & list access util	$16
Level I or II:	inventory	$20
	cassette data base	$20
	check balance & security	$15

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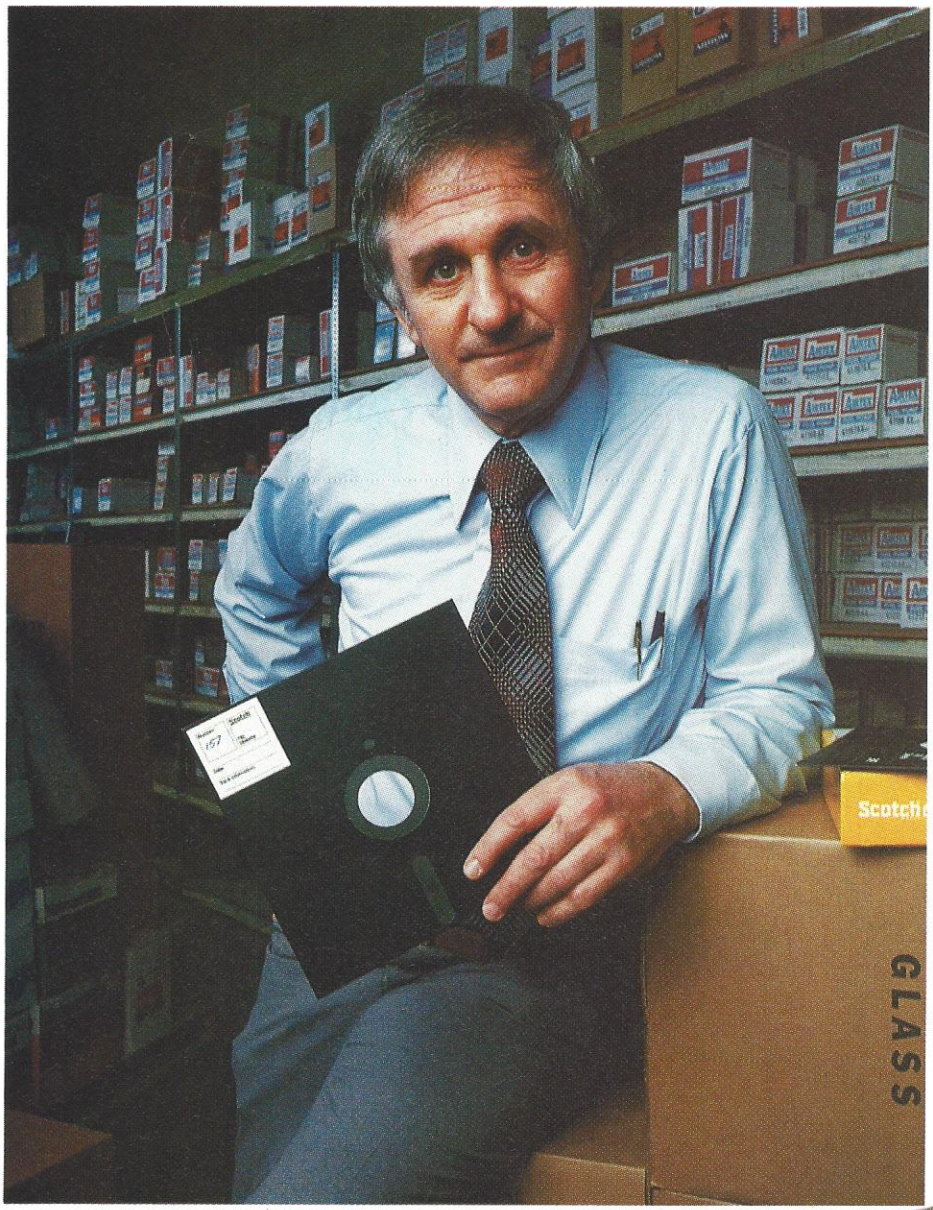

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CIRCLE 3

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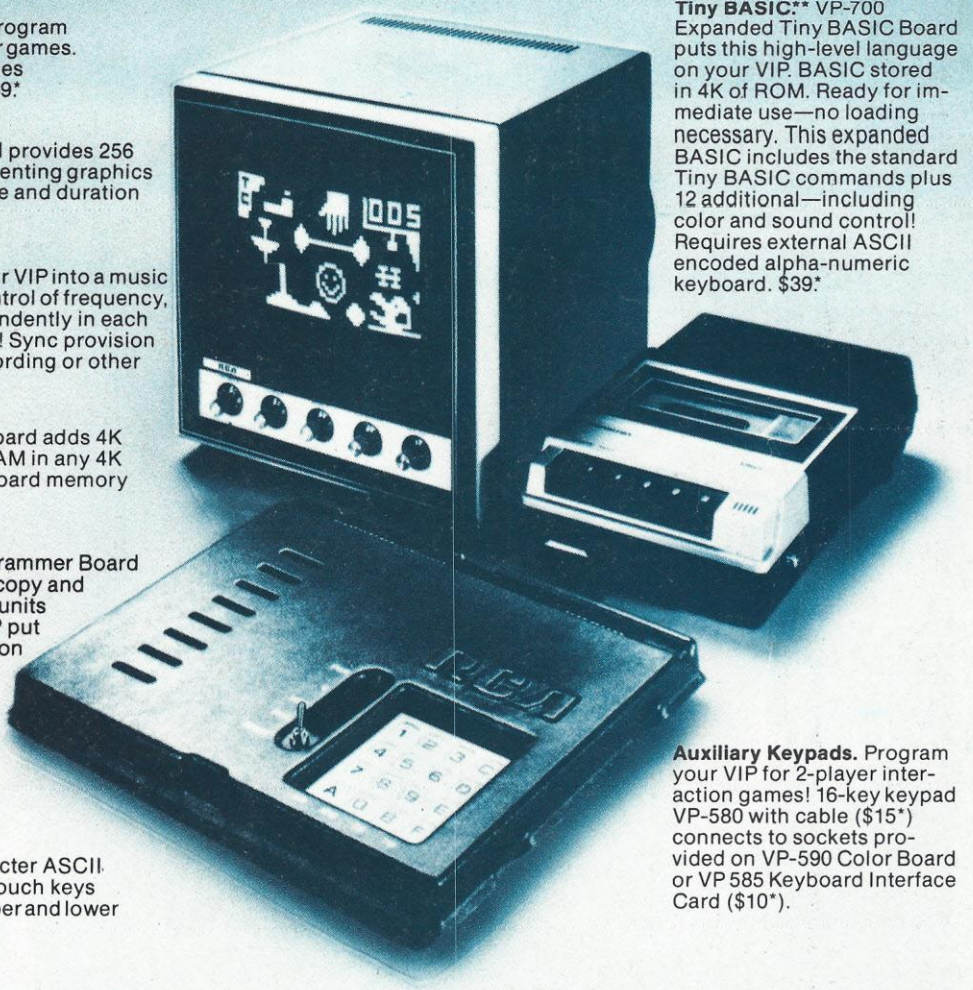

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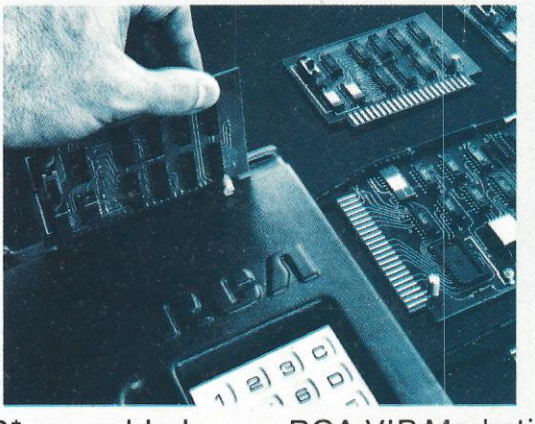

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CIRCLE 2